

INSTRUCTION MANUAL

MODEL 1010A DUAL TRACE OSCILLOSCOPE

For units with Serial No. Prefix 040: 15 MHz and CH1 and CH2 variable gain controls;
also, internal graticule option MOD 59.

With backdating information for units with Serial No.
Prefix 031: 10 MHz without CH1 and CH2 variable gain
controls, and units with Serial No. Prefix 033: 10 MHz
with CH1 and CH2 variable gain controls.

For 1010A MOD 59 units with Serial No. Prefix 032,
refer to instruction manual P/N 90100361A.

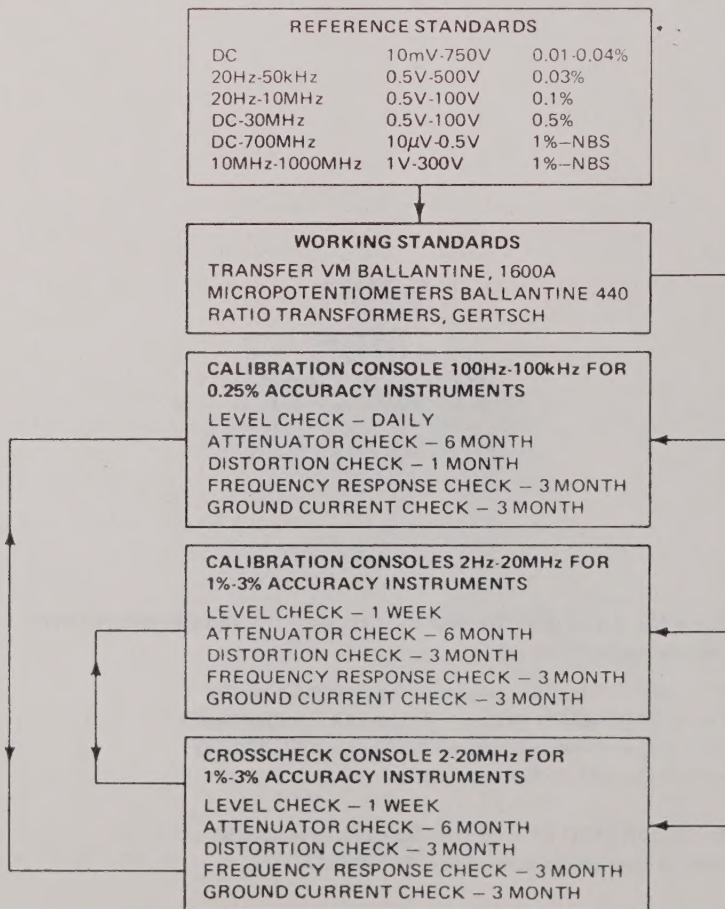
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WARRANTY

This Ballantine Laboratories, Inc. product is warranted against defects in materials and workmanship for a period of one year from the date of shipment, except for batteries, electron tubes, vacuum thermocouples, and certain other components, if any, listed in this manual. Ballantine Laboratories, Inc. will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Ballantine Laboratories, Inc. prepaid, and provided the proper preventive maintenance and calibration procedures as listed in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BALLANTINE LABORATORIES, INC. IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

CERTIFICATION

Ballantine Laboratories, Inc. certifies that this equipment meets all applicable Ballantine specifications at time of shipment as determined by thorough testing and inspection. Ballantine further certifies that its measurements are traceable to the United States National Bureau of Standards. All instruments used in calibrating Ballantine products are standardized by systematic reference to NBS-traceable standards as described in the validation procedures shown below.



General Information

The 1010A general purpose oscilloscope is a solid state, portable, dual trace oscilloscope suitable for a diverse number of laboratory and field maintenance applications. Bandwidth at the -3dB points is DC to 15 MHz, and AC mode bandwidth is 2 Hz to 15 MHz. Rise time is 24 nsec.

Sensitivity from 5 mV/cm to 20 V/cm is covered in 12 switched ranges. Several display modes are incorporated: CH1 or CH2 single trace; CH1 and CH2 dual trace with alternate sweep or 250 kHz chopped and automatically selected by the setting of the timebase switch; X-Y in which the precision attenuators in one Y channel are utilized to control the amplitude of the X signal.

Sweep speeds from 0.5 S/cm to 1 $\mu\text{s}/\text{cm}$ are covered in 8 switched ranges with a common variable overlap control effective on all ranges. A X 10 magnifier is incorporated so that the sweep speed can be increased to 100 ns/cm.

Switch selected trigger sources are, internal from either one of the two Y channels, and external via a front-panel BNC connector. A facility for triggering from television signals is also incorporated.

Level control may be effected manually or automatically. In the absence of trigger signals in the 'Auto' mode, the timebase switches to an automatic free run condition and produces a bright line trace. A special feature of the 1010A scope is trigger level control in the 'Auto' mode.

The cathode ray tube provides a full 8 X 10 cm display. The CRT operates at a full 3600 volts of accelerating potential to provide an exceptionally bright display for this class of scope. The display is easily viewed in well illuminated work areas.

The 1010A is a rugged, easy to maintain, and its 7 kg (15 lbs.) weight makes it the lightest portable dual trace scope with a full size CRT.

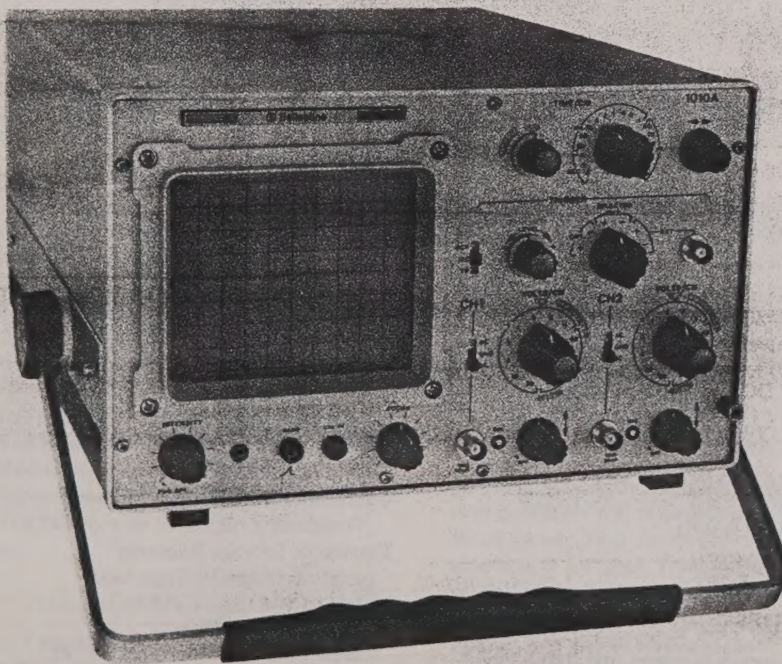


Figure 1-1. Ballantine 1010A Dual Trace Oscilloscope

Section 2

Specifications

DISPLAY

5 in. flat faced CRT giving 8 cm X 10 cm display
3.6 kV overall accelerating voltage.

Phosphor—P31. Long persistence (P7) available as an option.

VERTICAL DEFLECTION

Two identical input channels. CH1 and CH2
Bandwidth: DC—15 MHz (2 Hz—15 MHz on AC) at -3 dB.
Sensitivity: 5 mV/cm to 20 V/cm in 1-2-5 sequence.
12 positions with 1-2-5 sequence. Accuracy $\pm 5\%$.
Variable Gain: $\times 1$ to $\times 2.5$. Continuously variable vernier gain control. Detent stop provides calibrated position. Maximum clockwise rotation provides $\times 2.5$ gain for maximum calibrated sensitivity of 2 mV/cm (accuracy $\pm 5\%$) at full bandwidth.
Input Impedance $1\text{M}\Omega$ /approx. 28 pF.
Input coupling DC-GND-AC.
Protection 400V DC or pk AC to 1KHz. Derated linearly to 10 volts at 10MHz.

DISPLAY MODES

Single Trace CH1 or CH2.
Dual Trace chopped or alternate modes, automatically selected on timebase switch. Chop rate approx. 250kHz.
X-Y mode with CH1 input giving X deflection and CH2 input giving Y deflection.
Bandwidth DC to 500kHz. $< 3^\circ$ phase shift at 20kHz.

HORIZONTAL DEFLECTION

Timebase—1 μ s/cm to 0.5s/cm in 18 ranges (1-2-5) sequences.
Accuracy $\pm 5\%$
X Expansion— $\times 10$ pull switch gives fastest speed of 100 ns/cm. Accuracy $\pm 5\%$.
Variable control gives $> 2.5:1$ reduction in sweep speed to 1.25 sec/cm and 12.5 sec full screen

TRIGGER

Variable level control with option of bright line AUTO sync in absence of signal. Sweep free-runs in absence of signal in AUTO mode.

Trigger level control range (Normal and Auto mode)

INTERNAL $> 8\text{cm}$
EXTERNAL $> 20\text{V}$

Source:

Internal CH1 + or -
CH2 + or -

External + or -

External trigger input impedance, approx 100k Ω /10pF.
BNC connector
Protected to 100V DC and 100V pk AC

Coupling AC, AC fast, TV Frame.

Sensitivity:

Internal	2mm approx. 40Hz—2MHz.	AUTO triggering
External	1V approx. 40Hz—2MHz.	with level
Internal	1cm approx. 8Hz—10MHz.	Manual Level
External	5V approx. 8Hz—10MHz.	

Internal 2cm pk/pk video on TVF

ADDITIONAL FACILITIES

Calibrator: 1V $\pm 2\%$ square wave at power line frequency.
Risetime $\approx 20\mu\text{s}$ (usable for probe compensation)
Source Impedance $\approx 1\text{K}\Omega$
Ramp output: 0 to 10 volts. Source Impedance 18K Ω
Axis Modulation Input: AC coupled. 10V gives visible modulation (2Hz to 10MHz). 70V gives full blanking.

SUPPLY

103 to 127 (115V)	48 to 440 Hz
198 to 242 (220V)	48 to 440 Hz
215 to 264 (240V)	48 to 440 Hz

Approximately 20 watts

TEMPERATURE RANGE

Operating: 0 to 50°C
Full Accuracy: $\pm 1^\circ\text{C}$ to 35°C
Nominally 2% additional tolerances from 0°C to 15°C and 35°C to 50°C
Storage: -40°C to +75°C

ALTITUDE

Operating 3Km (10Kft)
Storage 15Km (50Kft)

HUMIDITY

Constant operation at 40°C and 90% relative humidity.
Intermittent operation within the specified temperature range and all humidity conditions which prevent condensation.

TRANSIT

Unit will meet National Safe Transit test when factory packaged. Vibration for one hour at 1.2G and 76 cm (30 inch) drops on corners, edges and flat surfaces.

DIMENSIONS

18cm (7") X 29cm (11 3/8") X 42cm (16 1/2")
Approx. 7 kg (15 lbs.).
Rack mount option (800-0 Kit)
Width — 483mm (19 in.)
Depth behind panel — 395mm (15 1/2 in.)
Height — 180mm (7 in.)

SUPPLIED ACCESSORIES

1 each Instruction manual
1 each Power cord (31100000A)
1 each CRT filter blue

AVAILABLE ACCESSORIES

Probe Kit, Attenuator 10:1; 10M Ω , 11 pF;

110 mm (3 1/2 ft.)	10600 Series
150 mm (5 ft.)	10601 Series
RF Detector head for probe (200MHz)	85100120A
Viewing Hood 8 x 10 cm	10702A
Protective Soft Luggage Style Cover	10725A
Cover, Front Panel	10750A
Calibrator; Amplitude, Time and Rise time	6125A
Electronic Storage Recorder	
Endless Magnetic Tape loop	
DC to 100 kHz	7050A/B
Rack mount assembly	800-03
with BNC Feedthru connectors	800-02
Cable, BNC to BNC 120 mm (48 in.)	12249D
Cable, BNC to BNC 22 mm (8 in.)	12249A
Cable, BNC to Alligator Clips	
120 mm (48 in.)	12250A
Termination, 50 Ω , BNC Feedthru	12630A

Operation

3-1. SWITCHING ON

CAUTION

The 1010A relies on convection cooling and must always be operated in a position such that external air circulation is not restricted.

1. Set the support/carrying handle to the required operating position. The handle is released by pulling both detent bushings outward, and it may then be turned to lock in any one of 5 positions.
2. A three-position slide switch on the rear of the instrument provides selection of 115V, 220V, or 240V AC power input. Always set this switch in the proper position for the line voltage being used. The 115V fuse rating may be used for all power input voltages.

CAUTION

Connection of the instrument to the incorrect power voltage may cause serious damage and will void the warranty.

NOTE

Instruments below Serial No. 031-0600 do not incorporate a power voltage selector switch. See paragraph 5-1(c) for details and wiring conversion.

- (b) Capacitive coupling of the input signal through an internal 0.1 μ F 400V capacitor, set the slide switch to AC.

NOTE

When examining low amplitude a.c. signals superimposed on a high d.c. level, the slide switch should be set to AC and the sensitivity of the Y amplifier increased as in (4).

3. To locate the baseline, set the slide switch to the 'ground' setting. At this setting, the input signal is open circuit and the input of the amplifier is switched to ground.
4. To select the sensitivity, set the VOLTS/CM switch to the required range. Adjust the VARIABLE GAIN control of each channel to the calibrated detent stop position or, if required to maximum gain clockwise rotation. To minimize pick-up at sensitive settings, it is essential that the ground lead connection is near to the signal point.
5. For vertical shift of the trace, adjust the Y position controls (identified with vertical arrows).
6. Any trace movement under no signal conditions, when the setting of the VOLTS/CM switch is altered, can be minimized by adjustment of the BAL screw driver adjustments.

NOTE

This control will only need adjustment at infrequent intervals. Before adjusting the BAL preset control ensure that the input slide switch is set to the 'ground' setting.

3-2. OBTAINING A TRACE

1. To obtain a trace
 - (a) Set the CH1 position control to approximately mid setting
 - (b) Set the CH2 position control to OFF.
 - (c) Set the X position control to approximately mid setting.
 - (d) Set the TRIG level Control to normal (auto) position and mid range i.e. not pulled out for BRIGHT LINE OFF.
 - (e) Set the TIME/CM switch to 5 μ s
 - (f) Adjust the INTENSITY control to obtain a display of the required brightness.
 - (g) Center the display by adjusting the CH1 and X position controls.
 - (h) Adjust the FOCUS control to obtain a sharply defined trace.

3-3. SETTING UP THE Y CHANNELS

1. Using a coaxial input signal cable, connect a signal to the CH1 or CH2 input BNC connectors.
2. For
 - (a) Direct connection of the input signal, set the associated AC-GND-DC input slide switch to DC.

3-4. SINGLE TRACE

1. For single trace operation on CH1 set
 - (a) The CH1 position control beyond the OFF setting.
 - (b) The CH2 position control to OFF.
2. For single trace operation on CH2, set
 - (a) The CH2 position control beyond the OFF setting.
 - (b) The CH1 position control to OFF.

3-5. DUAL TRACE OPERATION

In the dual trace mode, the Y channel switching function is in operation and results in independent display of two input signals. Two modes of beam switching — chopped and alternate — are used. They are automatically selected by the setting of the TIME/CM switch. At any fast setting from 1 μ s to 0.5ms, inclusive, the alternate switching mode is in operation. At slow settings from 1 ms to 0.5s inclusive, the chopped switching mode is in operation.

For dual trace operation, rotate both:

- (a) The CH1 position control to its operating range
- (b) The CH2 position into its operating range

3-6. TIMEBASE AND X EXPANSION

The sweep speed of the internal timebase (i.e. the time scale of the horizontal axis) is determined by the setting of the TIME/CM switch. (The setting of the switch automatically determines which mode of beam switching is used during dual trace operation.) In addition to selection of the speed of the internal timebase, the switch has one further position, X-Y, which makes the internal timebase inoperative.

1. To adjust the time scale of the horizontal axis:
 - (a) Set the TIME/CM switch to a suitable setting.
 - (b) If necessary rotate the uncalibrated VARIABLE control. It is normally placed in the clockwise "calibrated" position.

NOTE

The range of the VARIABLE control is approximately 3:1. Except at the CAL (cw) setting, the VARIABLE control is uncalibrated. At the CAL setting, the calibration corresponds to the setting of the TIME/CM switch.

2. For horizontal position of the trace, adjust the X position control (identified by horizontal arrow).
3. If close examination of any portion of the trace is required, operate the PULL X10 control. This facility is available at all settings except X-Y of the TIME/CM switch, and effectively increases the sweep length from 10cm to 100cm. Any portion of the increased sweep length may be selected for viewing on the display by use of the X position control.

3-7. X - Y MODE

When the TIME/CM switch is set to X-Y, the CH1 input is switched to the X amplifier. Under this condition, an external signal applied to the X (CH1) BNC is routed through the input attenuators in CH1, and the full range of the sensitivity may be utilized to obtain a calibrated horizontal deflection. Only single trace operation (CH2 Y input) is possible. In this mode, the CH1 position control is inoperative and the X position control moves the trace horizontally. The X bandwidth is limited to 500KHz and thus the relative phase shift between X and Y is significant only above 20 KHz. It is less than 3° to 20 KHz and typically <8° to 100 KHz.

3-8. TRIGGER

The timebase may be triggered from the positive or negative slope of the signal selected by the TRIG SELECT switch as follows:

- (a) CH1 or CH2 signal (irrespective of which beam is displayed).
- (b) An external triggering source connected to the EXT TRIG BNC connector.

When the LEVEL control is pulled out to select normal manual Trigger Leveling, the timebase will only trigger when the trigger signal reaches the selected level. When the LEVEL control is set outside the range of signal or when there is insufficient signal amplitude the timebase will not run and the screen will remain blank.

The Auto mode of operation is with the LEVEL control pushed in, when the timebase will free run in the absence of the correct trigger to display a bright line or unsynchronised display until the level control is adjusted and/or the amplitude of the trigger signal is increased. This free run action in the absence of correct trigger helps in finding the trace and leads to ease of operation. If the timebase is required to free run continuously, the LEVEL control should be set to either end of its rotation.

The ability to level select in Auto mode is a feature of this oscilloscope.

It is expected that the Manual Level (Pull) mode will be selected only when the instrument is to be used to display signals at low or high repetition rates.

The TRIG SELECT switch is used in conjunction with the ACF-AC-TVF slide switch. This switch connects different networks into the trigger amplifier circuit and is effective at all settings of the TRIG SELECT switch. The operating facilities available at the three settings of the slide switch are as follows:

- AC Wideband trigger mode used for most signals.
- ACF A filter is switched into circuit to reject low frequencies. High frequency triggering may be effected from complex waveforms such as those with high ripple content or line triggering from a television video signal waveform.
- TVF A filter is switched into circuit to reject high frequencies. Its cut off is chosen to accept the frame sync of a TV video waveform and reject the TV line frequency component.

Triggering control is accomplished as follows:

1. Set the TRIG SELECT switch to select the required trigger signal and slope.
2. Set the ACF-AC-TVF switch to the required setting.
3. Adjust the LEVEL control so that the trace starts at the required point on the waveform.

3-9. ADDITIONAL FACILITIES

(a) Cal

This connector provides a DC coupled positive-going square wave of 1V ±2% amplitude at line frequency for calibration checks. The square wave has a source impedance of 1kΩ and a rise time of approximately 20μS. Time base may be checked for calibration by observing 3 cycles at 60Hz power line and 2 1/2 cycles at 50Hz power line when the TIME/CM switch is set to 5 mS/cm. (See Fig. 3-2)

(b) Ramp

This jack on the front panel provides a d.c. coupled positive going timing ramp of approximately 10V amplitude generated by the timebase. Source impedance is 18kΩ.

(c) Z Mod

The jack on the rear panel allows an a.c. coupled signal to modulate the brightness. Coupling is by an internal 0.02μF capacitor into 4.7MΩ. The input resistance at this jack is 100kΩ. (2Hz - 10MHz)

1. Sensitivity is approximately 10V pk-pk for visible modulation at normal brightness.
2. Full blanking requires a 70V negative-going pulse.

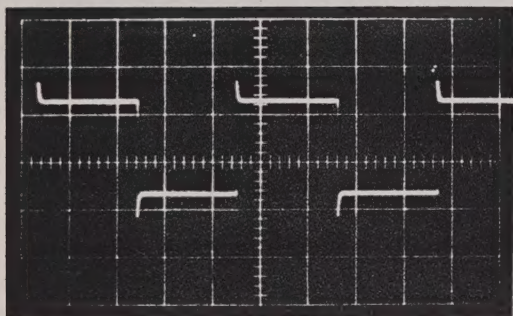
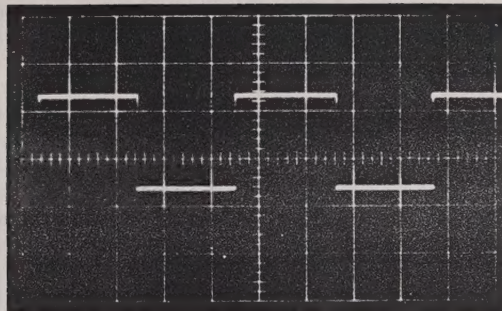
PROBE COMPENSATION

Using CAL 1 V jack on panel

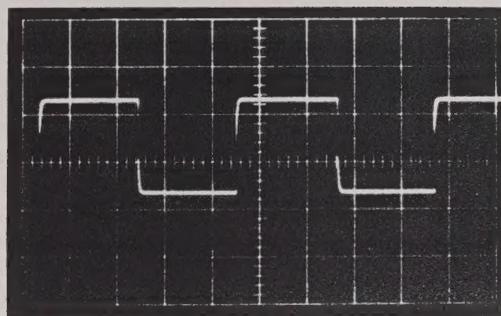
0.5 V/cm Y

5 ms/cm X

Proper Adjustment of Probe
Compensating Capacitor

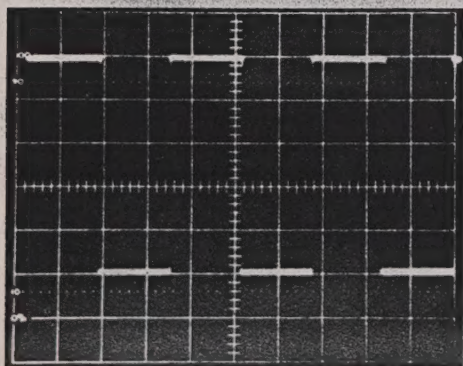


Over Compensated



Under Compensated

Figure 3-1. Probe Compensation



Amplitude/Sensitivity Calibration

Direct input to dc coupled input of
amplifiers

Attenuators set at 200 mV/cm

Line Frequency Square Wave from
Cal 1 V jack on panel

200 mV/cm Y

5 ms/cm X

Figure 3-2. Amplitude/Sensitivity Calibration

(d) Use of Optional Attenuator

A X10 passive probe may be used to extend the voltage range and increase the input impedance of the Y amplifiers. The input resistance of a Y channel is $1\text{M}\Omega$, shunted by approximately 28 pF . The effective capacity of the input lead must be added to this and the resultant impedance can often load the signal source. Therefore it is advisable to use the $10\text{M}\Omega$ X 10 probe, 10601C. This reduces the input capacity and increases the input resistance, at the expense of the sensitivity. The probe contains a shunt RC network in series with the input and forms an attenuator with the input RC of the Y channel. To obtain a flat frequency response it is necessary to adjust the capacitance of the probe to match the input capacity of the Y channel as follows:

1. Set the Y channel VOLTS/CM switch to 0.02V , and the TIME/CM switch to 5 ms .
2. Connect the probe to the CAL 1V . Adjust the probe compensating capacitor for level response with no overshoot or undershoot visible in the display. (See Fig. 3-1)

3-10. ELECTRONIC SIGNAL & TRANSIENT STORAGE

To obtain "storage" display operation Ballantine provides the 7050A endless magnetic loop tape recorder. Transients are readily recorded and displayed electrical recall and delayed sweep expansion is possible for window of 20 ms and risetime of $3.5\text{ }\mu\text{sec}$.

3-11. CAMERA

A camera may be attached to the oscilloscope to record waveforms. This facility is particularly useful for the slow speed timebase settings.

3-12. PHASE SHIFT MEASUREMENTS

Phase shift measurements are usually made when the frequencies of the two input ac signals are equal. Hence, Lissajous figures that result from a phase difference between

two input signals of the same frequency are often referred to as phase difference patterns. When using very low frequency sine waves, dc coupling should be used to eliminate phase shifts due to the coupling circuits.

To check the relative phase shift, proceed as follows:

1. Apply one sine wave signal to X INPUT and the second signal to Y INPUT.
2. Center the trace horizontally and adjust the Y controls for 8 centimeters of vertical deflection. The pattern obtained should be similar to Figure 3-3.
3. The angle between the two signals is that angle whose sine is the ratio A/B .

NOTE

To obtain full scale vertical deflection of 8 centimeters , it may be necessary to temporarily reduce the horizontal amplitude of the display. To accomplish this, set the X VOLTS/CM switch one step counterclockwise from its initial setting. Adjust the display for 8 centimeters of vertical deflection. Reset X VOLTS/CM switch to its original setting; recenter the display, and read dimension A in Figure 3-3.

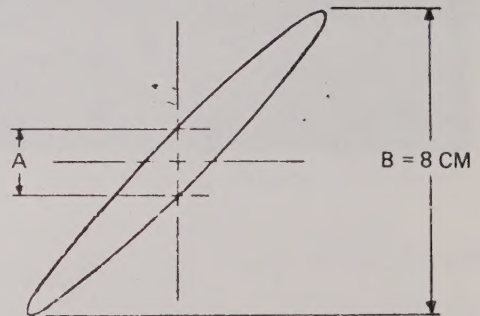


Figure 3-3. Phase Shift Measurements

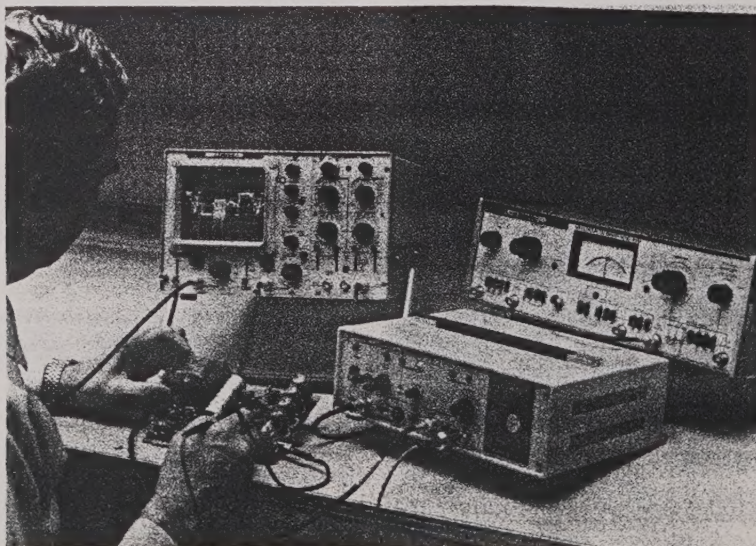


Figure 3-4. Typical Setup Using 7050A Electronic Signal Recorder

Principles of Operation

4-1. GENERAL

Referring to the block diagram (Fig. 4-1) signals applied to the CH1 and CH2 input connectors pass into their respective attenuators and amplifiers. The VOLTS/CM switch controls the gain of the amplifier in the necessary 1, 2, 5 sequence to cover the ranges from 5 mV/cm to 0.2V/cm. Above this $\div 100$ attenuator is introduced before the amplifier on the 5 mV/cm to 20 V/cm ranges. The VARIABLE GAIN control adjusts the amplifier gain on all settings of the V/cm switches. It is calibrated in the detented counterclockwise position at the sensitivity of the V/cm switch and provides increased gain (X2.5) as it is rotated to the clockwise end which is also calibrated and provides a maximum sensitivity of 2 mV/cm.

NOTE

Instruments with Serial No. Prefix 031 do not incorporate CH1 and CH2 variable gain controls, but have fixed sensitivities of the V/cm switch setting.

The fast electronic beam switch selects either the CH1 or the CH2 signal to be amplified further and passed to the Y deflection plates of the CRT.

A sample of each signal is taken and passed to the trigger

switch, where selection of CH1, CH2 or Ext trig source is made. The selected signal is amplified and passed to the Schmitt trigger, where it is converted into fast negative-going pulses. The hold off circuit acts as a gate which is normally open to allow a trigger pulse to set the timebase bistable. The bootstrap ramp generator then begins to generate its linear ramp, which after passing through the X amplifier is applied to the cathode ray tube and drives the electron beam linearly across the tube face. A small portion of the signal from the ramp generator is fed back to the hold off circuit, shutting the gate to prevent any further pulses from the Schmitt trigger from reaching the timebase bistable during the ramp period. When the ramp has reached the necessary maximum level, the timebase bistable is reset, and the ramp is quickly returned to its quiescent state. A time constant in the hold off circuit now holds the gate closed to inhibit another ramp from being initiated for a short period, until the ramp timing capacitor is discharged fully. Thus a ramp is generated at a rate set by the TIME/CM switch when the trigger signal reaches a predetermined level. This ramp sweeps the beam across the CRT face, returns and waits for the next trigger point to be reached. The timebase bistable is connected to a blanking amplifier whose function is to turn on the electron beam during the sweep and blank it off during the fly back and subsequent waiting period.

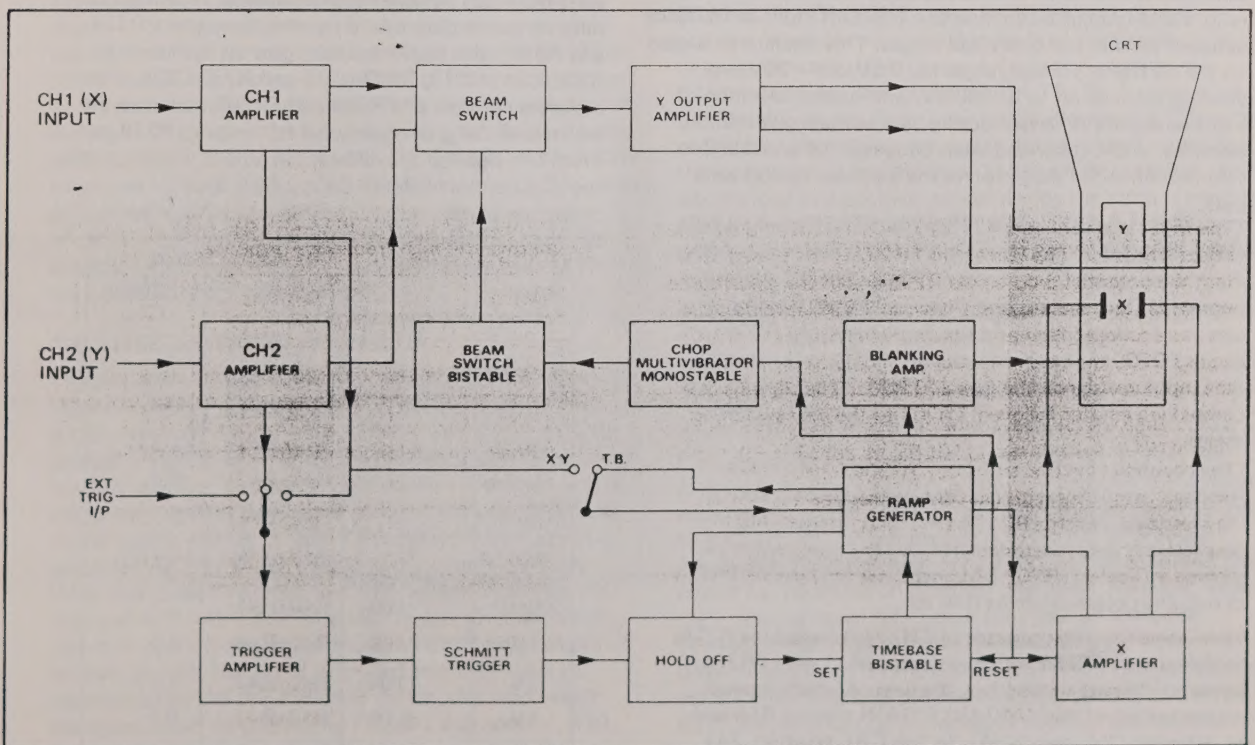


Figure 4-1. Block Diagram

At fast sweep rates for a dual trace display, the TIME/CM switch automatically selects the alternate sweep mode of control for the beam switch. At the end of each sweep the signal from the timebase bistable reverses the state of the beam switch bistable, causing alternate displays of the CH1 and CH2 signal on successive sweeps of the timebase. At slow sweep rates, the chop mode is selected. When the chop multivibrator free runs independently, it causes the beam to switch between CH1 and CH2 levels during the sweep. A signal from the multivibrator also blanks the trace during each switching transition. With CH1 or CH2 switched to the OFF position the beam switch bistable is locked to switch on the other channel.

In the X—Y mode, the signal from the CH1 amplifier, normally used for trigger, is passed via the ramp generator, which acts as a voltage follower, to drive the X plates while the beam switch selects CH2 to drive the Y plates. The beam blanking signal is not used and the CRT beam is on continuously.

4.2. THE Y AMPLIFIERS

The attenuator and pre-amplifier in CH1 are identical to those in the CH2. Accordingly, only CH1 is described.

The input signal is applied to the front panel BNC SKA and then to the 3 position slide switch S20, via R26. The switch selects AC or DC input coupling by including or by-passing C21 in the signal path. The attenuator feeds into an impedance of 1 M Ω (R529). The $\div 100$ attenuation is determined by the potential divider action of R20 in series with the parallel combination of R529 and R201. High frequency compensation of the attenuator is achieved by the AC potential divider C202 and C203; C202 is set for the correct ratio. C201 is adjusted to maintain constant input capacitance between divided and undivided ranges. This attenuator is used on the six higher voltage ranges i.e. 0.5V/cm — 20V/cm, dividing them down to 5—200mV/cm. Further selection of input sensitivity is carried out by gain switching within the amplifier, and is described later. Diodes D201 and D202 in conjunction with R528 protect the input up to 400 volts peak.

The input stage consists of TR201 and TR202, a dual field effect transistor. The current in TR202 is self biased such that the potential drop across R205 equals the gate/source potential. This same current flows in TR201, which operates as a source follower on the input signal. As R207 equals R205 the base potential of TR203 always equals the input voltage on the gate of TR201. The signal is passed via emitter follower TR203 to the gain switching stage.

The grounded emitter transistor TR304 forms a shunt feedback amplifier with gain determined by the ratio of the feedback resistor R211 to the input resistor R40 in parallel with the resistor selected by the range switch as shown in Table 1. R202 (BALANCE) sets the base of TR203 to null the potential across R40 etc.

The signal from the collector of TR204 is passed via R214 to the base of TR205 which in conjunction with TR206 forms a differential amplifier, the gain of which depends on the setting of the VARIABLE GAIN control R58 and its detented CAL switch S41. In this CAL position, S41 connects R217 between the emitters of TR205 and TR206 to set the CH1 sensitivity. At the X2.5 clockwise rotation position of R58, only R297 is connected. At all other settings

of R58, R297 is in series with the parallel combination of R58 and R298. Capacitors C206, C241 and C247 compensate the high frequency gain of the VARIABLE GAIN control circuit. The collector current of TR205 feeds into the trigger section of the timebase and 'X' amplifier circuit. Potentiometer R52 provides a variable current via R219 into the collector circuit of TR206, to produce 'Y' positioning. The bases of TR206 (CH1) and TR216 (CH2) are driven from the collector circuit of TR217 which being connected in a similar manner to TR204 and TR214 provides the correct bias and compensation for supply and temperature variations.

The beam switch, consists of diodes D203, D204, D206 and D207, with their associated drive circuitry and is described in detail in section 4.3. It selects the collector current of TR206 or of TR216 to pass through D205, R203 and R223. R223 and TR223 form the output load of TR206 and TR216 and, therefore, their gain. TR223 is used to temperature compensate the base emitter voltage of TR207. The low impedance of the feedback circuit insures that R223 functions as the primary gain determining component. The voltage developed across R223 consists of a fixed d.c. component, a variable d.c. component (Y positioning) and the signal and is applied to the base of TR207, a common emitter amplifier. The emitter circuit includes potentiometer R222, to set the gain of the stage and hence the overall gain of the Y amplifier. The signal from the collector of TR207 is passed to the base of TR208, which with TR209, TR210 and TR211 forms the output cascode stage. TR208 and TR209, is a differential amplifier which converts the input signal voltage to differential output current, its gain is determined by emitter resistors R234 and R236, with high frequency gain set by networks R232/C211/C212, R233/C213 and R236/C236. The collector currents of TR208 and TR209 flow into the emitters of the grounded based transistors TR210 and TR211 to develop the differential output voltage across the load resistors R230/R240 to drive the CRT deflection plates. Inductors L201 and L202 are included to improve the high frequency response.

Switch Setting	Attenuation	Resistor Used	Amplifier Gain
5mV	$\div 1$	R40+R45	5
10mV	$\div 1$	R40+R44	2.5
20mV	$\div 1$	R40+R43	1.25
50mV	$\div 1$	R40+R42	0.5
100mV	$\div 1$	R40+R41	0.25
200mV	$\div 1$	R40 only	0.125
500mV	$\div 100$	R40+R45	5
1V	$\div 100$	R40+R44	2.5
2V	$\div 100$	R40+R43	1.25
5V	$\div 100$	R40+R42	0.5
10V	$\div 100$	R40+R41	0.25
20V	$\div 100$	R40+ only	0.125

4-3. THE BEAM SWITCH

The emitter of D203 is supplied with a 6 volt positive-going square wave from the multivibrator TR218/TR219. When the waveform is "high", D203 is biased off and the collector current of TR206 passes through D204 into the output amplifier. During the low state of the waveform D203 conducts, passing this current to ground through TR219. As diodes D203 and D207 are fed with complementary waveforms, when the current from TR206 passes to the output amplifier, that from TR216 is shunted to ground and vice-versa.

Bistable TR218/TR219 is switched with pulses from TR220/TR221, the chop multivibrator.

This emitter coupled circuit free runs at approx. 500kHz on TIME/CM settings from 0.5s to 1ms, causing the bistable to operate the beam switch at 250kHz. In addition to driving the bistable, an output from the collector of TR221 is fed to the cathode of the CRT to blank the trace during the beam switching transitions. The mark/space ratio of the multivibrator is approx. 1:4, causing the trace to be blanked for one fifth of each switching period.

At faster TIME/CM settings of 0.5ms to 1 μ s, the lower end of R292 is taken to -20V by a contact on the timebase switch biasing off TR221, and preventing oscillation. The circuit now acts as a monostable, triggered via C220 at the end of each sweep by pulses from the timebase bistable, each output pulse reversing the beam switch bistable and rapidly blanking the trace.

For single trace operation, the Y position control on the channel not required is rotated fully counter clockwise to operate the OFF switch. In this position, the switch S27 or S28 is closed, connecting the cathode of its associated diode to the negative line. This biases off the relevant transistor in the multi. Thus when CH1 is turned off, S27 closes, biasing off TR218; TR219 turns on and sinks the current from CH2 to ground through D203. A versal occurs when CH2 is turned off. In the X-Y mode, both shift controls are set to the on position; a contact on the TIME/CM switch in parallel with S27 is used to bias TR218 off, allowing CH2 signals only to reach the Y output stage.

4-4. THE TRIGGER CIRCUITS

The collector currents from TR205 and TR215 in the Y amplifier pass to the timebase printed circuit board into R108 and R109 respectively. In series with R108 is R110 shunted by C101, a collector load network used when X-Y mode is selected. External trigger signals appear across R107, and these, together with those across R108 and R109 pass to the trigger selector switch. The selected trigger signal is amplified by TR107 and passed to the coupling switch. Here, high pass, direct and low pass networks provide the required ACF-AC-TVF filtering. Trigger level and slope selection operations are performed by differential amplifier TR101/TR102. The signal is applied to either input as determined by the slope selector switch, the other input being grounded via C121. The Trigger Level control, R10, provides a variable d.c. bias at both inputs, which the am-

plifier sums with the signal. The output at the collector of TR102, consisting of an alternating signal voltage superimposed on a d.c. level, passes to the Schmitt Trigger TR103/TR104, where fast negative edges are generated as the input signal crosses the circuit threshold.

4-5. THE TIMEBASE BISTABLE MULTI AND RAMP GENERATOR

The ramp generator comprises TR111, TR112 and TR113 as cascaded emitter follower stages, with bootstrap feedback action provided from the cathode of Zener diode D104. This feedback maintains constant voltage across the VARIABLE TIME control R11, R148, R147 and the timing resistor selected by the TIME/CM switch. This constant voltage drop, independant of actual voltage level produces a constant current to linearly charge the timing capacitor, also selected by the TIME/CM switch. The VARIABLE TIME control provides fine adjustment of the timing current, and hence sweep time, by varying the feedback voltage applied to the timing resistor.

In the quiescent condition of the timebase bistable, TR108 is on, TR109 is off and clamp transistor TR110, which shunts the timing capacitor, is saturated. A negative-going pulse from the Schmitt Trigger is coupled via C111 and D102 to turn off TR108. TR109 turns on, thus turning off TR110. The clamp is removed, allowing the timing capacitor to charge, producing the linear ramp. As the emitter of TR113 rises, a feedback voltage, via D105, R143 and R133 biases off D102 to prevent any further pulses from reaching the bistable. Connected to the junction of R133 and R143 is the HOLD OFF capacitor which now charges positive. When the ramp reaches its final amplitude, a rise of approximately 10V, feedback from the junction of R151/R149 is applied to the base of TR108, turning it on. The bistable reverts to its initial state allowing TR110 to turn on, rapidly discharging the timing capacitor and returning the ramp to its quiescent level. The hold off capacitor, which was charged to a positive voltage during the ramp, now slowly discharges through R143 and R153, until it is caught by D105. Only then is D102 biased for the next trigger pulse to initiate the next sweep.

An output is taken from the ramp generator via R155 to SKE, the RAMP OUT jack on the front panel.

4-6. BRIGHT LINE AUTO CIRCUIT

When sufficient trigger signal is available, the square wave from the collector of TR104 passes through R127/C104, where restoration by D101 produces a negative going signal with respect to the negative rail. This negative signal on the base of TR105 is integrated by R124/C107 to produce a d.c. bias sufficient to hold off TR106. In this condition the circuit has no effect on timebase operation. However, when the triggering signal falls below the required level, the Schmitt trigger ceases to operate, removing the signal from D101. The voltage on the emitter of TR105 rises to approximately one volt above the negative line, turning on TR106. R177 is now effectively connected between the negative rail and the cathode of D102. It rapidly discharges the hold off

capacitor below the normal quiescent level to a point where D102 conducts, turning TR108 off and initiating a sweep. At the end of the ramp, the charge on the hold off capacitor is again removed by R177/R143 and another ramp begins. These consecutive sweeps produce the bright line display. When the level control is PULLED to manual mode switch S10 closes, effectively shorting the base and emitter of TR106, holding it off, in this condition a sweep is only generated after the arrival of a trigger pulse.

4-7. THE X OUTPUT AMPLIFIER

The ramp or X-Y signal at the emitter of TR113 passes through R156 to the base of TR114, which with TR117 forms a long tail pair. Gain switching is carried out in the emitter circuit by selection of one of two resistance paths with gains set by R169 (X1) and R16/R162 (X10). In time-base mode, the PULL X10 switch S14 can be operated in order to expand the trace length ten times. In the X-Y mode contacts on the TIME/CM switch, is parallel with S11, close to select this higher gain setting automatically. An X POSITION voltage is produced at the base of TR117 by R12. The signals on the collectors of TR111 and TR117 are applied to the differential output amplifier. TR115 and TR116. Signals from the collectors of these two transistors drive the horizontal deflection plates of the CRT.

4-8. X-Y MODE

In this mode, signals are applied to both CH1 and CH2 input connectors; CH2 is routed through the beam switch to the Y deflection plates in the normal manner. CH1 is routed through the ramp generator, now acting as a high impedance unity gain buffer, and into the X output stage.

Signals entering CH1 pass through the attenuator and gain switching stage, as described previously. Current from TR105 passes to the X board, while that in TR206 is shunted to ground through D203. The current from TR205 develops a voltage across the series connection of R110, R108. This voltage is level-shifted by R144/R146 to the base of TR111. In the X-Y mode, both timing resistors and capacitors are switched out of circuit consequently TR111, TR112 and TR113 merely act as emitter followers which provide buffering between the level-shift resistors and the X output amplifier.

When this mode is selected, a contact on the TIME/CM S14 (a) switch connects the cathodes of D106 and D107 to the negative line. The current drawn through D106 and R138 turns off TR108 and consequently TR110, and removes blanking. (see section 4-11)

Current through D107 controls the state of the beam switch bistable multi. (see section 4-4)

4-9. POWER SUPPLIES

The primary winding is connected in series or parallel to provide three ac power input voltage ranges selected by rear panel slideswitch S31 (S90 in instruments above Serial No. 031-0600). In instruments below Serial No. 031-0600, which do not incorporate a switch, the transformer primary leads must be rewired.

See paragraph 5-1(c). The primary winding can be connected to accept six supply voltage ranges.

The transformer secondary has four windings developing the following r.m.s. voltages; 6.3V, 44V (center tapped), 140V and 1000V.

The 6.3V winding supplies the CRT heater which sits -1.3kV d.c. off ground.

The 44V a.c. is rectified by MR32 and filtered by C33/C34 to form the unregulated $+26\text{V}$ and -26V d.c. lines. These voltages are fed to series regulators to provide the regulated $+20\text{V}$ and -20V lines. As both regulators operate in an identical manner, only one will be described.

The base of series pass transistor, TR32, is fed from the output of the high gain error amplifier formed by TR305/TR306. This amplifier compares the zener reference voltage from D316 with the voltage at the junction of R310/311, a potential divider connected between the emitter of TR32 and ground. As this emitter supplies the $+20\text{V}$ line, any fluctuations in the line voltage appear at the base of TR306 where they are amplified and inverted. This signal is then fed to the base of TR32 to correct the error, thus maintaining a constant output voltage. Resistor R309, in series with the collector of TR32, drops a voltage which is proportional to the output current. Under normal conditions, this voltage drop is less than that across R307, biasing off D310. As the output current rises above the safe maximum, D310 turns on, taking the current in R307 away from the emitter of TR305. This causes a drop in voltage at the collector of TR306 and hence on the base and emitter of TR32, limiting the current to a safe value.

The voltage from the 140V winding is rectified by MR31 and filtered by C31 to provide the unregulated 170V supply.

The 1000V winding energizes both the -1.2kV and $+2.4\text{kV}$ supplies. Half wave rectification of the negative half cycle by D301 produces the negative line, while voltage doubling by D302/D303 produces the positive. Regulation of both lines against supply variation is achieved as follows. One end of the 1000V winding feeds the diodes mentioned above. The other end passes to ground through bridge rectifier MR301. The alternating current in the winding passes through the rectifier as direct current via R338 and TR301, developing a filtered direct voltage across C315. This voltage, controlled by the conduction of TR301, forms a threshold above which the alternating voltage applied to the bridge must rise before current can flow. As this threshold must be reached on both positive and negative excursions of the supply waveform, the overall effect is to take the middle out of the sine wave, thus reducing its voltage. This controlled voltage is rectified to produce the E.H.T. supplies. R322 feeds a negative current into the base of TR302, proportion to the peak value of the regulated waveform. This current is balanced by a reference current from the + line fed via R319 and SET E.H.T. potentiometer R320.

The voltage at the summing point of the two currents appears at the emitter of TR302 and controls the current flow through D304, which in turn controls the conduction of TR301. As it is this conduction which controls the alternating voltage from which the feedback is derived, a

closed loop circuit is formed. Variations in the magnitude of voltage across the 1000V winding either increases or decreases the voltage on the -1.2kV line. Feedback from this line is compared with a reference and the conduction of TR301 is varied accordingly to bring the line back to its correct voltage. As the $+2.4\text{kV}$ line is derived from the same regulated source as the -1.2kV , it also remains constant.

4-10. CALIBRATOR

The $1\text{V} \pm 2\%$ square wave at the CAL 1V jack, SKD, is produced by TR307, on the power supply board. Current for the base of this transistor is supplied via R305 and D311. The anode of D312, is connected to the junction of these two components, its cathode being taken to one of the 22V windings. On positive excursions of the winding, D312 is biased off, and the current through R305, D311 saturates TR307. During negative excursions, D312 conducts, and the current in R305 passes through the transformer winding. In this condition D311 and TR307 are turned off. The result is a square wave on the collector of TR307, at line frequency, with amplitude set by adjustment of R304.

4-11. BLANKING

The signal which blanks the CRT when a sweep is not occurring is produced by TR308. The base of this transistor is fed via R135/C118 from the collector of TR108 in the timebase bistable. When TR108 is on, no current flows in R135, thus TR308 is off and its collector is at approximately 70V, as determined by R335, R336 and R337. This voltage is fed to the beam blanking plates of the CRT, pin 5, and blanks the trace. As TR108 turns off to initiate a sweep, the current in R135 turns TR308 on; its collector voltage falls

to about 3V, where it is held by the action of the forward biased diode, D313. Under this condition CRT blanking is removed. Blanking is not effected in the X-Y mode as TR108 in the timebase bistable is permanently turned off.

When dual trace operation is selected, a pulse is coupled via C314, from the collector of TR221 into the cathode of the CRT in order to blank the trace during the channel switching transition.

Z Modulation

Signals applied to SKF on the rear panel pass via C313 to the grid of the CRT where they produce trace intensity modulation.

4-12. CRT NETWORK

The cathode of the CRT draws current from the -1.2kV line through the Intensity control, R33. Clockwise rotation of this control decreases the grid potential, and hence varies the tube conduction from cut off to maximum. Electrons emitted from the cathode are focussed into a narrow beam by potentials on the focus and astigmatism electrodes. These potentials are approximately -850V and $+80\text{V}$, controlled by R34 and R332 respectively.

When a positive potential is applied to the blanking plates, the electron beam is deflected to one side of the tube, thus preventing the electrons striking the tube face. The geometry control R333 varies the potential on an electrostatic shield placed between the X and Y deflector plates to minimize interaction. After deflection by the X and Y plates, the electron beam is accelerated by the PDA potential of $+2.4\text{kV}$, to strike the phosphor coated tube face at high velocity, and produce the display.

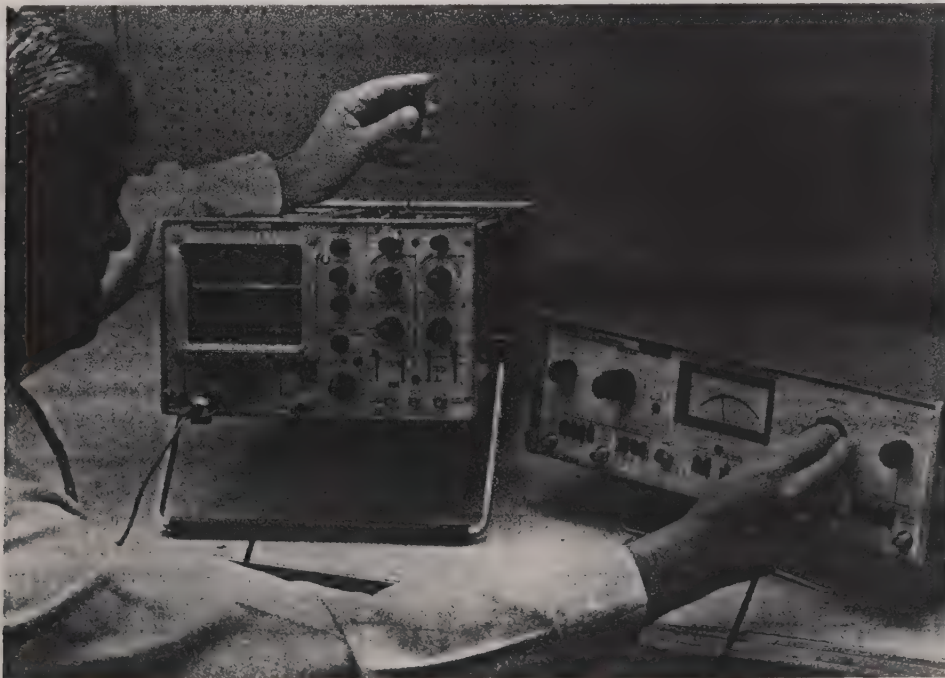


Figure 4-2. Scope Adjustment Using 6125A Oscilloscope Calibrator

Section 5

Maintenance

5-1. GENERAL

Figures 6-7 and 6-8 show the location of subassemblies and preset controls. Access to all preset controls and most other components is obtained by removing the top and bottom covers. Full access to all components can be achieved by removing the Y amplifier sub assembly or timebase and X amplifier sub assembly.

For details fault finding the instrument can be operated with either assembly out of the frame and with the inter-connecting leads extended.

(a) Removal of Covers

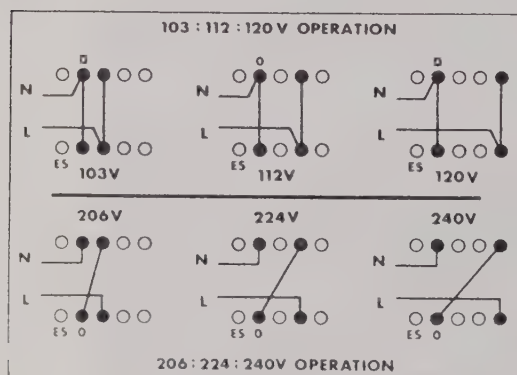
Each cover is retained in position by four latch fasteners. Each fastener is released by turning it one quarter of a turn counter-clockwise.

(b) Line Voltage Selection

For units with serial numbers above 031-0600 use the voltage selector slide switch on the rear panel.

(c) Transformer Tap Connections (S/N below 031-0600)

DISCONNECT THE INSTRUMENT FROM THE SUPPLY BEFORE ADJUSTING THE TRANSFORMER TAPS. The transformer tap connections for each of the normal supply voltages are shown below. It will be seen that the two tapped primary windings are connected in series or parallel as necessary. The 'line' is the brown lead from the fuse and the 'neutral' is blue. The ground wire from the power card is tied to chassis.



(d) Fuse Replacement

DISCONNECT THE INSTRUMENT FROM THE SUPPLY BEFORE CHANGING THE FUSE. The 500mA slow blow fuse is mounted on the inside of the rear panel, above the transformer.

5-2. REMOVAL OF SUB-ASSEMBLIES

Removal procedures for each of the Printed Circuit Board assemblies are outlined below. However, almost all the components in the instrument, with the exception of those in the early stages of the Y amplifiers, are accessible without recourse to board removal.

(a) Y Amplifier Sub-assembly.

1. Remove and identify the leads from pins 9, 10, 11, 12, 13, 16, 17, 21, 23, 25 and 29 on the above named assembly.
2. Remove and identify the leads from pins 5 and 41 on the time base board.
3. Remove the two screws holding the heat sink plate to the side bar of the instrument, and remove the screw from the rear of the assembly.
4. Remove the knobs from both CH1 and CH2 attenuator switches and position controls.
5. Remove the switches nuts from the bushings of the attenuator switches.
6. The assembly can now be removed. With the assembly out of the instrument, the attenuator shields can be released by removal of four screws.

(b) Timebase and X Amp Sub-assembly

1. Remove and identify leads from pins 21, 23 and 25 on Y amp board.
2. Remove and identify leads to pins 5, 10, 11, 26, 33, 41, 43, 44, 45 and 46.
3. Remove two screws at rear of assembly.
4. Remove the knobs from VARIABLE TIME, X SHIFT and TRIG LEVEL controls, from TIME/CM and TRIG SELECT switches.
5. Remove nuts from TIME/CM and TRIG SELECT switches.
6. The assembly can now be removed.

(c) CRT Replacement

CAUTION

The CRT is a high vacuum tube. Use extreme care. Do not scratch or mar the glass. Use gloves and wear safety goggles whenever handling the CRT.

1. Remove the tube base connector.
2. Remove the Post Deflection Anode (PDA) cap from the CRT.
3. Remove lead from pin 21 on power supply board.
4. Remove screw holding tube shield to the tube support clamp and the two screws from tube clamp. Loosen the CRT face mounting screws and bushings.

5. Slide the tube and tube shield back to clear the front panel mountings and remove the tube and shield from the instrument. The tube can then be withdrawn from the shield.
6. Replace the tube in the reverse order.

When the tube is replaced it may require rotation to align the trace with the graticule (see Section 5-4d). Always make certain the CRT faceplate is firmly in contact with the graticule to be sure that the rubber mounting bushing completely contacts the CRT envelope and provide secure support before fully tightening these bushings. Failure to properly reinstall the CRT may cause CRT breakage and trace rotation during shipment or use.

5-3. FAULT FINDING

Before any fault location is attempted, it is suggested that all supply line voltages are checked with respect to chassis ground.

LINE	MEASURED VOLTAGE	
+20V	+19 to +21V	
-20V	-10 to -21V	
+170V	+160 to +180V	
PDA	> +1,900V	Use meter at least
*-1.2kV	-1,140 to -1,240V	20,000 Ω /V.

* Measured at junction R322, R324

CAUTION

Attach meter to circuit with instrument turned off to avoid contacting high voltages. Use caution whenever working on voltages above 30 volts.

NOTE

The power supply input voltage should be approximately at the middle of the range for which the transformer taps are connected.

Table 3, indicating voltages at various circuit locations, may be used as a general guide and servicing aid. The front panel controls should be set as follows:

INTENSITY	— at mid position
Y POSITION	— at mid position
CH2 POSITION	— at mid position
CH1 POSITION	— to CH2 OFF position
TRIG SELECT	— to CH1 +
ACF, AC, TVF	— to A.C.
LEVEL	— to mid position, BRIGHT LINE on.
TIME/CM	— to X-Y

Adjust X and CH2 position controls to bring spot to center of tube.

If a fault on a printed circuit board cannot be cleared it is recommended that the instrument is returned to Ballantine

or a fully equipped service shop for repair. When faults have been cleared it is recommended that the full calibration procedure is followed. Calibration adjustments should be made only after a 15 minute warm up period after turning the oscilloscope ON.

LOCATION

TYPICAL VOLTAGE

Y Amplifier Sub-assembly

Base TR203, TR222	0V
Collector TR204, TR214, TR217	+7V
Pin 22	+3.6V
Pin 21	+3V
Collector TR207	+9.3V
Pins 9 and 10	+110V
Emitter TR221	12V

X Amplifier & Timebase Sub-assembly

Collector TR107	+4V
Collector TR102	+13V
Collector TR106	-20V
Collector TR109	+0.1V
Emitter TR113	+5.5V
Emitter TR115, TR116	-6.8V
Pins 34, 37	+92V

Power Supply Sub-assembly

Emitter TR302	+0.5V
Collector TR308	+3.5V

5-4. CALIBRATION PROCEDURE

(a) Test Equipment (See Table 5-1)

(b) Power Supply Voltages

With the transformer connected for 111 to 130V operation, connect the instrument to the A.C. supply via a variable autotransformer, and set the voltage to 120V $\pm$ 1%. If the supply transformer is not connected for 111 to 130V operation, the test should be carried out with the supply within 1% of the nominal voltage.

Check the voltages to chassis on the following pins on the power supply board:

+20V	+19.0V min.	+21.0V max
-20V	-10.0V min	-21.0V max
+170V	+160V min	+180V max
PDA	> +1900V	

Adjust R320 (EHT) to give 175V across C315. Unless the instrument is supplied from a known stable source, the supply voltage should be checked at the same time that the potential to chassis which should be between -1140 to -1240V. This voltage should not change by more than $\pm$ 12V when the supply voltage is varied by $\pm$ 10% of the nominal power line voltage selected by S31.

(c) Astigmatism

Set the front panel controls as follows: TIME/CM switch to X-Y, INTENSITY to mid position, X position to mid range, CH1 and CH2 position controls to mid range and CH1 and CH2 VOLTS/CM switch to 2. Adjust X and CH2 position to center a spot on the screen. Adjust R332 (Astig) together with the INTENSITY and FOCUS controls to obtain a sharp round spot.

Table 5-1. Test Equipment

REQUIREMENT	INSTRUMENT OR EQUIVALENT
1. Oscilloscope Calibrator	Ballantine 6125A
a) Voltage 30 mV to 300 V $\pm 1/4\%$ 1 kHz squarewave	
b) Time Mark Generator 0.5 μ s to 5 sec. $\pm 0.02\%$ Sine Wave 20ns and 50ns	
c) Fast Rise Square Wave Generator 1MHz, 100kHz, 10kHz, 1 sec Nominally 250mV into 50 Ω Risetime < 1 ns Flattop, minimum perturbations	
d) Line Frequency Sine Wave Line Frequency, filtered 10mV to 1 Volt uncalibrated	
2. Multimeter	Ballantine 3028A or Simpson 260
Volts AC/DC, 0-2.5 μ V AMPS AC/DC Ohms, Input $> 20,000\Omega$ /Volt 5% Accuracy	
3. A.C. True RMS Voltmeter	Ballantine 323L or 3620A
1 mV to 300V rms 2% Accuracy to 100kHz) 2Hz to 20MHz	
4. Variable Auto Transformer	General Radio W5MT3AW
95 to 135 Volts	
5. Sine Wave Generator, Constant Amplitude	Tektronix 190/191
0.1 to 2.5 volt p-p 50 kHz to 50 MHz Flatness $\pm 3\%$	
6. Alignment tool, Insulated	JFD 5284
7. 50 Ω Termination, Feedthru	Ballantine 12630A
BNC/BNC — 1 Watt	
8. Resistor	Ballantine 12-12528-OA
196 kohm $1/4$ W 1% Film, RN-55	
9. Capacitance standardizer	Ballantine 10650A
28 pF — shielded High Impedance frequency compensated attenuator with BNC Connectors giving 2X attenuation when used with 1M Ω 28 pF load. Accuracy within 5% to 100kHz	
10. Attenuator, 50 Ω , 20dB ± 0.3 dB	Ballantine 12626A or General Radio 874-G20
Flat dc to > 100 MHz GR 874 to BNC Adapters (2)	
11. Cable, BNC/BNC, RG58A/U,	Ballantine 12249D
120 cm, (4 ft.) 20 cm, (8 inches),	Ballantine 12249A
12. Cable, BNC/Alligator clips	Ballantine 12250D
120 cm, (4 ft.)	
13. TV Video Waveform Generator	Optional

(d) Trace Rotation

Set the TIME/CM to 1ms/cm and bright line auto on. Rotate the CRT to bring the trace exactly parallel with the horizontal graticule line. It may be necessary to loosen the CRT face support screws to rotate the CRT.

CAUTION

Use gloves and safety glasses when handling the CRT.

Tighten all screws after rotating CRT.

(e) Geometry

Set the CH2 position to OFF, CH1 input switch to A.C., Trigger Selector to CH1 and TIME/CM to 1 μ s. Apply a 1kHz sinewave to the CH1 input BNC. Set the sine wave amplitude to give approximately 8cm of Y deflection. Set the TIME/CM switch and LEVEL control so that approximately 10 cycles are displayed. Adjust R333 (Geom) for a compromise between horizontal and vertical pin-cushioning and barrelling effects. Reset the FOCUS, and if necessary adjust R332 (Astig).

(f) DC Balance

Set the CH1 and CH2 input switches to ground. Adjust the CH1 and CH2 BAL controls to eliminate X and Y trace movement when CH1 and CH2 VOLTS/CM are switched from 0.2V/cm to 0.5V/cm. Switch back to 0.2V/cm and adjust R296 (CH1 Gain Control Balance) and R596 (CH2 Gain Control Balance) to eliminate trace movement when CH1 and CH2 VARIABLE GAIN controls are rotated.

(g) Timebase Calibration (Use 6125B Calibrator)

Switch TIME/CM to 1ms/cm, variable time in CAL position. Apply 1ms markers to CH1 input, adjusting Y sensitivity to give approximately 2cm amplitude and triggering without bright line auto. Adjust R169 (X1 Gain) for 1 pulse/cm. Set X10 switch on, change markers to 0.1ms/cm and adjust R162 (X10 Gain) for 1 pulse/cm. Switch X10 off and set TIME/CM to 10 μ s/cm. Change markers to 10 μ s and adjust C10 for 1 pulse/cm. Check the timebase accuracy on all ranges to specification. Check that the variable time control reduces the speed by greater than 2.5:1. Ensure that the trace length is greater than 10cm on all ranges. With 10X MAG on apply time markers and check that the speed accuracy is within specification on all ranges ($\pm 5\%$) ignoring the non-linearity on the first 5cm of the 0.1 μ s/cm. range. Switch off the X10 MAGnifier.

(h) Y AMP Calibration

Set both CH1 and CH2 attenuators to 0.2V/cm, both VARIABLE GAIN controls to CAL, both input switches to DC, and the TIME/CM to 5ms/cm. Apply 1V square wave (0.2V X5) from the calibrator to CH1

and adjust R222 (Y Gain) for a 5cm display. Apply the same signal to CH2 input, trigger on CH2 and observe the deflection. Readjust R222 to equalize the errors from 5cm deflection between CH1 and CH2. Error must be $< 5\%$ on any attenuator step for both channels.

Set both V/cm switches to 0.5 V/cm and check that both VARIABLE GAIN controls increase the displayed signal from less than 2cm to approximately 5cm (disregard overshoot). This checks VARIABLE GAIN X2.5 range. Return controls to CAL.

(i) Input Capacity and Attenuator Compensation

Capacitors C25 and C27 are selected such that the input capacitance is approximately 28pF.

To set the attenuator compensation, set the CH1 VOLTS/CM switch to 0.5, the input coupling to D.C. and the TIME/CM to 0.5ms. Connect a low impedance 3V, 1kHz square wave signal to the input and adjust C202 for a square top to the display.

Repeat for CH2, adjusting C222.

To equalise the input capacitance on all ranges, set the Y1 VOLTS/CM switch to 0.2, the input coupling to DC and the TIME/CM to 0.5ms. Use a Ballantine 10650A capacitance standardizer or connect a 1kHz square wave signal through a 10:1 probe. Set the input amplitude for approximately 6cm of display and adjust the standardizer compensation or the probe for a square top to the display. Set the CH1 VOLTS/CM switch to 0.5 and adjust C201 to regain the flat top to the display.

Repeat for CH2 adjusting C221 without readjusting the standardizer or probe.

(j) Internal Calibrator (Use 6125B Calibrator)

Set CH1 attenuator to 0.2V/cm then apply to CH1 input a 1V $\pm 1\%$ squarewave from the amplitude calibrator and note the exact deflection. Remove the 1V squarewave and apply the internal calibrator to CH1 input. Adjust R304 (Cal) to give the deflection previously noted.

(k) Trigger Sensitivity

Apply the CAL signal to the CH1 input, set to 5V/cm with TRIGGER set to CH1 and AC with AUTO off (Pull). Rotation of the LEVEL control should give a stable display of the correct slope in both + and - positions. Check that timebase does not free run at any setting of the LEVEL control. Push the LEVEL control in for Auto mode. Rotation of the LEVEL control should show range with a stable display of the correct slope in both + and - positions *but free running outside this range*. Remove the calibrator from the CH1 input and set this input to GROUND. Check that the timebase free runs at all settings of the LEVEL control in both + and - positions.

Repeat for CH2.

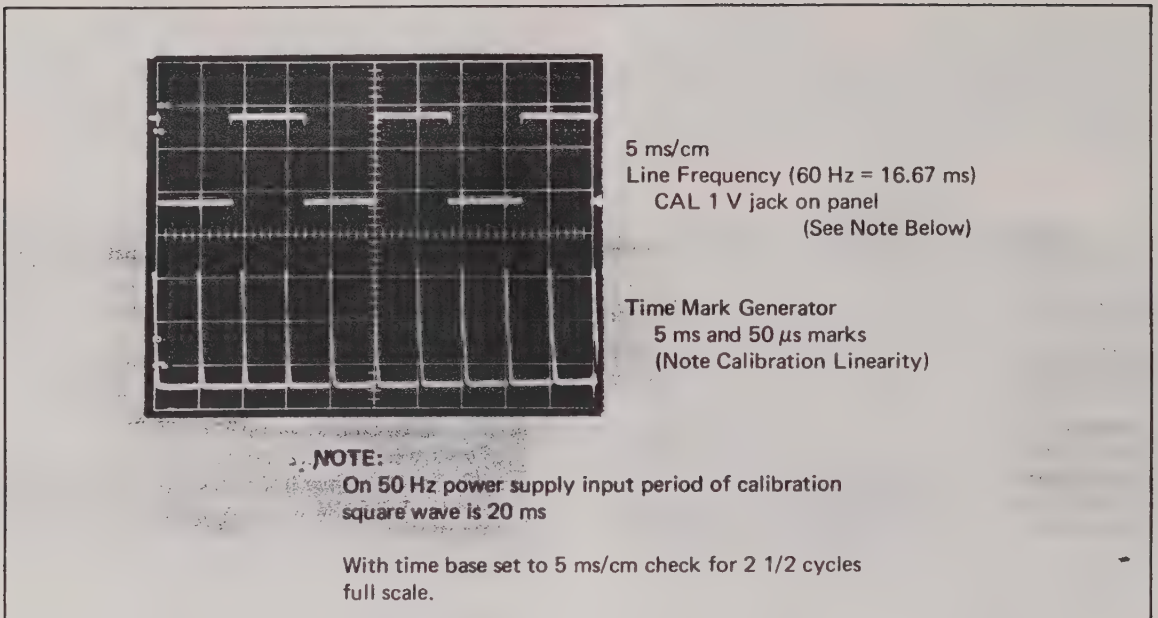


Figure 5-1. Horizontal Time Calibration

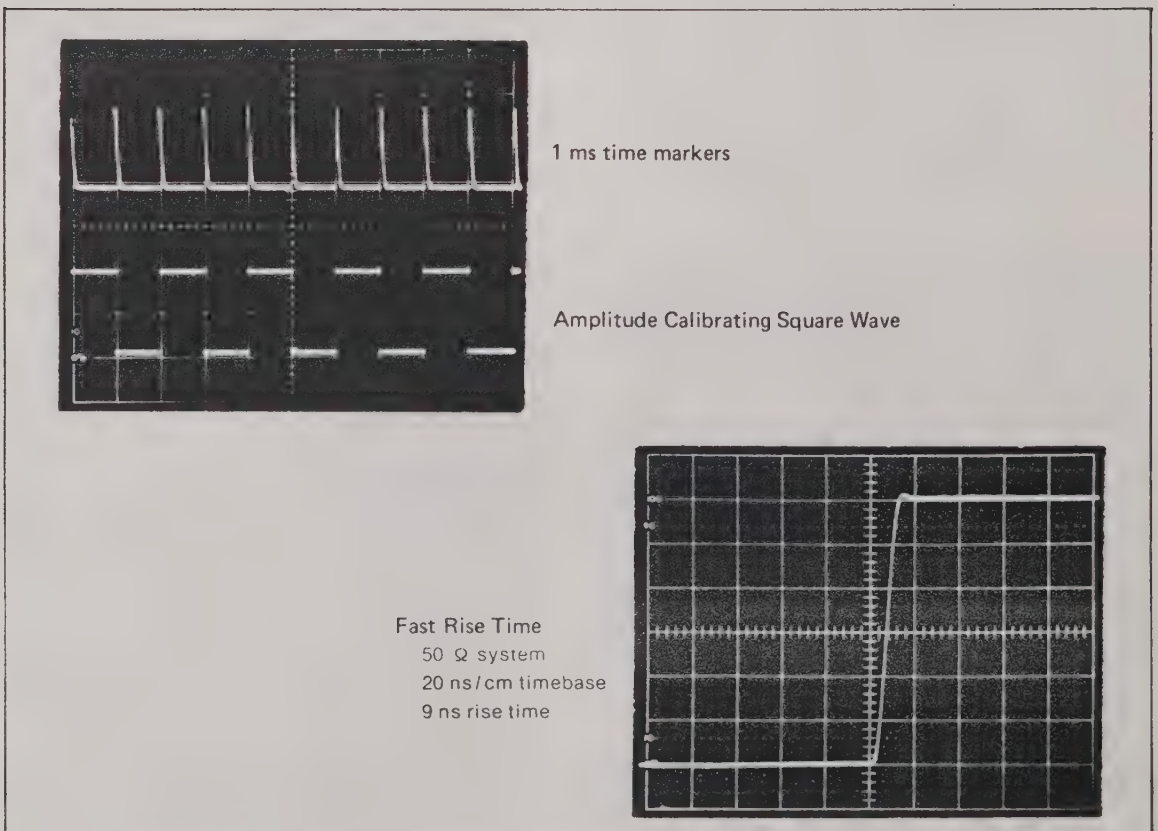


Figure 5-2. Ballantine 6125B Calibrator Waveforms

(l) **ACF AND TV Trigger**

Set CH2 attenuator to 1V/cm connect the internal calibrator and select ACF. Two stable trigger points of opposite slope should be found in the level control. Switch to TV, CH2+ and apply to CH2 input a composite video waveform from a video waveform generator or a TV receiver. Adjust CH2 attenuator to give 1 to 2cm display. Adjustment of the TRIGGER LEVEL control should give a stable display triggered from a video frame pulse. Remove the video input and return TRIGGER coupling switch to A.C.

(m) **EXT Trig**

With internal CAL signal applied to the CH2 input, the CH2 attenuator set to 5V/cm, and trig selector set to EXT, apply the CAL waveform also to the EXT trig BNC via a 196K Ω resistor. Check that the instrument LEVELS and triggers correctly with AUTO mode both on and off.

(n) **Pulse Response** (Use 6125B Calibrator)

Switch the CH1 attenuator to 5mV/cm and set TIME/CM to 1 μ s/cm. Apply a 100kHz fast (<1 ns) risetime square wave signal to CH2 input using a 50 Ω termination at the input BNC to prevent cable reflections. Adjust output amplitude from the calibrator to give 6cm display. Adjust C211 to extend the flat top towards the leading edge. Adjust C209 for a square corner. Apply the fast rise signal to CH2 to check the squareness of corner, then readjust C211 and C209 as necessary for a compromise square corner between CH1 and CH2 amplifiers. Check that the pulse response is square on all ranges between 2mV/cm and 0.2V/cm, adjusting the signal amplitude for 5cm on each range, to 50mV/cm and to maximum amplitude permitted by the 6125B calibrator when 50 Ω BNC termination is removed on the 0.1V and 0.2V/cm ranges, both CH1 and CH2 allowing a maximum of 4 percent overshoot or undershoot.

(o) **Bandwidth**

Set CH1 attenuator to 5mV/cm and apply the output of a constant amplitude generator to the CH2 input. Set frequency to 50kHz and adjust generator output to give 6cm display. Increase the frequency until amplitude falls to 4.2cm. This frequency should be greater than 15MHz. Repeat for CH2.

(p) **HF Trigger**

Switch off the AUTO Trigger Mode. With the constant amplitude generator applied to the CH2 input and the TIME/CM set to 1 μ s/cm, X10, set the generator frequency to 10MHz and adjust the output to give 1cm display. It should be possible to obtain a cleanly triggered waveform by adjustment of the level control. Repeat for the CH1.

(q) **X-Y Operation** (Use 6125B Calibrator)

Switch the TIME/CM to X-Y and both CH1 and CH2 attenuators to 0.2V/cm. Apply a 4V (.05V x8) 1kHz squarewave signal to the CH1 input BNC. The X deflection should be 8cm $\pm$ 5%. Apply 50kHz from the Constant Amplitude Generator to the CH1 input and GROUND the CH2 input. Adjust the generator to give a 10cm horizontal line.

Increase frequency until the line reduces to 7cm. This frequency should be greater than 500kHz.

(r) **Z Mod** (Use 6125B Calibrator)

Set the CH1 attenuator to 1V/cm and apply to both the CH1 input and to the Z mod jack at the rear of the oscilloscope a 10V 1kHz square wave. Check that blanking is operating at normal Intensity levels.

5-5. PACKING INFORMATION

The 1010A is a rugged instrument built to perform in severe environments. If the unit is to be shipped or stored for long periods of time the following packing procedure is recommended:

- Place the 1010A into an oversize plastic bag and seal the bag.
- Place the bagged 1010A into a heavy duty corrugated cardboard box. The box must contain at least 2 inches of rubberized hair or equivalent cushion on all six sides of the instrument. The instrument must fit snugly into the cushion and the cushion must fit into the box to prevent any movement of the instrument in transit.
- Place the instruction manual into the box. If accessories are also to be packed put them into a separate plastic bag and pack into the cushion leaving at least two inches of cushion between the instrument and the accessories as well as an extra cushion between accessories and the box.
- Seal the box fully with 2 or 3 inch wide packing tape.
- Properly label and address outside of box with a typed label or an indelible pen.

If shipment is to the factory, notify Ballantine in advance and include detailed reasons for return inside box along with your name, firm and full mailing address. Also include your phone number and purchase order number.

Ship prepaid by United Parcel Service or Registered Air Parcel Post to:

Ballantine Laboratories
90 Fanny Road
Post Office Box 97
Boonton, NJ 07005 USA

5-6 MOD 59 (Internal Graticule CRT and Electrical Trace Rotation).

Modification 59 adds internal graticule performance to the 1010A. The internal graticule in the cathode ray tube permits more accurate anti-parallax measurements. An electrical trace rotation control is also provided on the rear panel which permits aligning the horizontal trace on the cathode ray tube to the horizontal center line on the graticule. This trace rotation control is an operator adjustment which should be made whenever the oscilloscope is moved to different locations or other positions within earth's magnetic field.

See Power Supply Schematic Diagram Figure 6-5 for connection of MOD 59 components. No additional calibration adjustments are required.

Parts List and Circuit Diagrams

The replacement parts listed are available from the vendors listed or from Ballantine Laboratories. Your local Ballantine Field Engineering Representative may also carry a stock of parts and can assist you. If pricing quotations are required for parts and or repairs your local representative will give the most rapid service or you may contact the Ballantine Factory directly.

When ordering replacement parts always give the following information:

- a) Instrument Model number
- b) Serial number
- c) Ballantine Part number
- d) Schematic Symbol number
- e) Identification and description of the part

Ballantine will do its best to improve the instrument and make changes in style of components and replacement parts. Replacement parts may differ in appearance from those found in your instrument but are always equal or superior in performance. Where necessary minor mechanical modifications may be required in the replacement of the components.

Parts are generally available locally for most replacements. The parts list calls out the recommended vendors where applicable.

The instrument may substitute alternate components but the use of parts specified in this parts list is recommended. A part similar to the part initially installed at the factory may be used, i.e., a 5% composition resistor may be replaced with a similar part or a 5% film resistor or the preferred 1% metal film resistor. Use of the preferred component will always simplify calibration and speed repairs.

Any selected component is generally identified in this manual and may be replaced with a similarly valued part unless reselection is required due to replacement or change of its related part. The schematics and calibration procedures identify selected components and replacement procedures.

The Manufacturer Code is taken from Federal Supply Code Cataloging Handbooks H4-1, H4-2, and H4-3. Ballantine Code is 50423.

The following parts coding are used:

CVC	Capacitor, Variable, Ceramic
CCT	Capacitor, Ceramic, Tubular
CFP	Capacitor, Fixed, Plastic
CCD	Capacitor, Ceramic, Disc
CYF	Capacitor, Mylar, Foil
CMD	Capacitor, Mica, Dipped
CMM	Capacitor, Mica, Molded
CEA	Capacitor, Electrolytic, Aluminum
CET	Capacitor, Electrolytic, Tantalum
DGP	Diode, General Purpose
DZG	Diode, Zener, General Purpose
DRP	Diode, Bridge, Power
FLT	Filter
ICP	Integrated Circuit
TRQ	Transistor
RFF	Resistor, Fixed, Film
RFC	Resistor, Fixed, Composition
RVC	Resistor, Variable, Composition
RFW	Resistor, Fixed, Wirewound
SWC	Switch
LMP	Lamp
TRX	Transformer

Resistors may generally be replaced by Corning Electronics (CCW) type N-55, N-60 and C-32. Allen Bradley carbon composition resistors type EB may also be used but should generally be avoided (except for emergency replacements) in favor of the preferred part listed in this parts list.

INTERCONNECTION DIAGRAM (SERIAL NO. PREFIX 040 AND 033)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 10	07300010A	CVC005.5-25PF 350 V	72982	TYP 538-014.0, 5.5-25
C 11	07022960A	CMD 68.0PF 500.0 VJ	84171	ARCO DM-15-680J
C 12	07250060A	CYM 0.01UF160.0 VF +-1%	84171	ARCO DM30-1C3F
C 13	07100960A	CBM 1.0UF 200.0 VF	14752	ELFCT RCCUE 625CIC105F
C 14	07023710A	CMM 47 NF 200 V K 10%	56289	SPRAGUE TYPE 192P
C 15	07100590A	CYF 4.7UF 100.0V M	34553	AMPEREX C28CYAH/ANM7
C 16	07C95790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 21	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEADS
C 23	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEADS
C 25	07101520A	CCD 5.6PF 500.0 V NPC 10%	72982	FRIE 861 NPC 5.6PF 10%500
C 26	07025041A	CCT 2.7PF T	50423	999 STACKPOLE TYPE GA-SPC
C 27	07101520A	CCD 5.6PF 500.0 V NPC 10%	72982	FRIE 861 NPC 5.6PF 10%500
C 28	07025041A	CCT 2.7PF T	50423	999 STACKPOLE TYPE GA-SPC
C 31	07101720A	CEA 200.0UF 250.0 V CAN/CLMP	90201	MLRY CGS101T25C881/14F410
C 33	07101710A	CEA2200.0UF 40.0 V CAN/CLMP	90201	MLAY CGS222U040B81/14F410
C 34	07101710A	CEA2200.0UF 40.0 V CAN/CLMP	90201	MLAY CGS222U040B81/14F410
C 35	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 51*	07100060A	CCD 4.7pF 500 V DISC	90201	RMC TYPE CG
C 52*	07100060A	CCD 4.7pF 500 V DISC	90201	RMC TYPE CG
C 53*	07101170A	CMD 12pF 500.0 VJ	84171	ELMENCO DM15C120JN
C 54*	07101170A	CMD 12pF 500.0 VJ	84171	ELMENCO DM15C120JN
C 55*	07025440A	CCT 1.5pF	95121	QUALITY COMPONENTS TP QC
C 56*	07025440A	CCT 1.5pF	95121	QUALITY COMPONENTS TP QC
FS 30	19034110A	FUS .5A SLO BLO 20MM	75915	LITTLEFUSE 213.500
L 10	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 11	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
MR 31	05100060A	DGP W04M 400 1.5A	04713	GIC
MR 32	05100060A	DGP W04M 400 1.5A	04713	GIC
N 31	16100080A	LMP INDICATOR, NEON TYPE Q	95263	LEECRAFT 45RN2117
R 10	09100810A	RVC 100.0 K 0.5 W	50423	
R 11	09100820A	PVC 10.0 K 0.5 W	50423	
R 12	09100830A	RVC 2.2 K 0.5 W R12	50423	
R 13	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 14	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 15	12125460A	RFF 301.0 K 500 MW F+-1%	16299	CGW RN55D 3013 F
R 16	12125670A	RFF 499.0 K 500 MW F+-1%	16299	CGW RN55D 4993 F
R 17	12127910A	RFF 1.0 M 500.0MW +-0.5%	16299	CGW NA65 CR ACV26346
R 18	12150040A	RFF 3.01M 1.0 W F+- 1%	35929	CONSTANTA CO LTD N3
R 20	12026420A	RCF 990.0 K 500.0MW F+- 1%	03888	PYF TYP TP-500
R 21	12121320A	RFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 22	12121320A	RFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 23	12026420A	RCF 990.0 K 500.0MW F+- 1%	03888	PYF TYP TP-500
R 26	12121320A	RFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 27	12121320A	RFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 31	12124800A	RFF 68.1 K 500 MW F+-1%	16299	CGW RN55D 6812 F
R 33	09100840A	RVC 220.0 K 0.5W/SWC S30 R33	50423	
R 34	09100850A	PVC 1.0 M 0.5W R34	50423	
R 40	12124200A	RFF 16.2 K 500 MW F+-1%	16299	CGW RN55D 1622 F
R 41	12124200A	RFF 16.2K 500 MW F +1%	16299	CGW RN55D 1622F
R 42	12123680A	RFF 5.11K 500 MW F+-1%	16299	CGW RN55D 5111 F
R 43	12123230A	RFF 1.74K 500 MW F+-1%	16299	CGW RN55D 1741 F
R 44	12122860A	RFF 787.0 500 MW F +1%	16299	CGW RN55D 7870 F
R 45	12122520A	RFF 348.0 500 MW F+-1%	16299	CGW RN55D 3480 F
R 46	12124200A	RFF 16.2 K 500 MW F+-1%	16299	CGW RN55D 1622 F
R 47	12124200A	RFF 16.2K 500 MW F +1%	16299	CGW RN55D 1622 F
R 48	12123680A	RFF 5.11K 500 MW F+-1%	16299	CGW RN55D 5111 F
R 49	12123230A	RFF 1.74K 500 MW F+-1%	16299	CGW RN55D 1741 F
R 50	12122860A	RFF 787.0 500 MW F +1%	16299	CGW RN55D 7870 F
R 51	12122520A	RFF 348.0 500 MW F+-1%	16299	CGW RN55D 3480 F
R 52	09100860A	RVC 22.0 K 0.5W/SWC S27 P52	50423	

*Not used in Serial No. Prefix 033.

INTERCONNECTION DIAGRAM (SERIAL NO. PREFIX 040 AND 033) – Continued

SCHEMATIC REF		BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R	53	09100860A	RVC 22.0 K 0.5W/SWC S27 R52	50423	
R	58	89104501A	ASY 1010A VER V/CM SWCS21S26	50423	
R	59	89104501A	ASY 1010A VER V/CM SWCS21S26	50423	
S	10	09100810A	RVC 100.0 K 0.5 W	50423	
S	11	09100820A	RVC 10.0 K 0.5 W	50423	
S	12	25100000A	SWC SLIDE DP TT 1066ABS	50423	
S	13	25100631L	SWC 1010A TRIG SELECT ROTARY	50423	
S	14	25100641L	SWC 1010A TIME/CM ROTARY	50423	
S	20	25100000A	SWC SLIDE DP TT 1066ABS	50423	
S	21	25100651M	ASY 1010A VER V/CM	50423	
S	25	25100000A	SWC SLIDE DP TT 1066ABS	50423	
S	26	25100651M	ASY 1010A VER V/CM	50423	
S	27	09100860A	RVC 22.0 K 0.5W/SWC S27 R52	50423	
S	28	09100860A	RVC 22.0 K 0.5W/SWC S27 R52	50423	
S	30	09100840A	RVC 220.0 K 0.5W/SWC S30 P33	50423	
S	31	25100911A	SWC 3P3T SLIDE SWC	50423	
S	41	89104501L	ASY 1010A VER V/CM	50423	
S	42	89104501L	ASY 1010A VER V/CM	50423	
SKA		31033790A	CON UG-1094/U BNC,DAGE	29587	STATE ELECT.PARTS
SKB		31033790A	CON UG-1094/U BNC,DAGE	29587	STATE ELECT.PARTS
SKC		31033790A	CON UG-1094/U BNC,DAGE	29587	STATE ELECT.PARTS
SKD		48100020A	SOC 4MM BLK BANANA JACK	83330	HH.SMITH #1498-103 (BLK)
SKE		48100020A	SOC 4MM BLK BANANA JACK	83330	HH.SMITH #1498-103 (BLK)
SKF		48100020A	SOC 4MM BLK BANANA JACK	83330	HH.SMITH #1498-103 (BLK)
SKG		48100020A	SOC 4MM BLK BANANA JACK	83330	HH.SMITH #1498-103 (BLK)
V	1	21100070A	TBE CRT 4KV 8X10CM P3 1010A	50423	*

TIMEBASE AND 'X' AMPLIFIER (SERIAL NO. PREFIX 040 AND 033)

C	101	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C	102	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C	103	07100530A	CET 10.0UF 35.0V M	56289	SPRAGUE 1960106X003543
C	104	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C	105	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C	106	07095580A	CCD 33.0PF 500.0VK +-10%	56289	SPG TYP C0308102G330K
C	107	07101640A	CCD 470.0NF 100.0 V GMV	72982	ERIE 8131-100 651 474M
C	108	07095580A	CCD 33.0PF 500.0VK +-10%	56289	SPG TYP C0308102G330K
C	109	07101730A	CCD 270.0PF 500.0 V 10%	00656	AEROCVX GPX5F271K OR EQV
C	110	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C	111	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	112	07078350A	CEA 25 UF 25 V T	73445	AMPEREX C426AR/F25
C	113	07101640A	CCD 470.0NF 100.0 V GMV	72982	ERIE 8131-100 651 474M
C	117	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	118	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	119	07100370A	CCD 4.7NF 1.0KV DC	84171	FLMENDO TYPE CCD472
C	120	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C	121	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C	122	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	123	07200060A	CCD 22.0PF 500.0 VK N330	71590	CTL DD-220
C	126	07101670A	CVC000.7-6PF TRIMMER	50423	
C	128	07100670A	CSF 220.0PF 50.0V	25085	SIEMENS R31110A050220K
C	129	07095510A	CCD 10 PF 1 KV K 10%	84171	ARC TYP CCD-100
D	101	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI DC7 3 8
D	102	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	103	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	104	05100030A	DZG 1N 959B 8.2 15M .4	12954	DIC SI D07
D	105	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	106	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	107	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	108	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	109	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	110	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN

TIMEBASE AND 'X' AMPLIFIER (SERIAL NO. PREFIX 040 AND 033) - Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 101	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 102	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 103	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 104	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 105	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1090 F
R 106	12012510A	RFC 100.0 K 1.0 W J+- 5%	01121	A-B TYP GR
R 107	12122720A	RFF 562.0 500 MW F+-1%	16299	CGW RN55D 5620 F
R 108	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 109	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 110	12122760A	RFF 619.0 500 MW F+-1%	16299	CGW RN55D 6190 F
R 111	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1090 F
R 112	12122560A	RFF 383.0 500 MW F+-1%	16299	CGW RN55D 3830 F
R 113	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 114	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 115	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 116	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 117	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1090 F
R 118	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 119	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 120	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 121	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 122	12123160A	RFF 1.47K 500 MW F+-1%	16299	CGW RN55D 1471 F
R 123	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 124	12126000A	RFF 1.00M 500 MW F+-1%	16299	CGW RN55D 1004 F
R 125	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 126	12123640A	RFF 4.64K 500 MW F+-1%	16299	CGW RN55D 4641 F
R 127	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 128	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 129	12122080A	RFF 121.0 500 MW F+-1%	16299	CGW RN55D 1210 F
R 130	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 131	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 132	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 133	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 134	12124080A	RFF 12.1 K 500 MW F+-1%	16299	CGW RN55D 1212 F
R 135	12124240A	RFF 17.8 K 500 MW F+-1%	16299	CGW RN55D 1782 F
R 136	12123560A	RFF 3.83K 500 MW F+-1%	16299	CGW RN55D 3831 F
R 137	12123560A	RFF 3.83K 500 MW F+-1%	16299	CGW RN55D 3831 F
R 138	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 139	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 140	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 141	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 142	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 143	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 144	12123160A	RFF 1.47K 500 MW F+-1%	16299	CGW RN55D 1471 F
R 145	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 146	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 147	12127630A	RFC 2.2 M 600.0 MW J+- 5%	01121	A-B TYPE EB OR EQUIV.
R 148	12124800A	RFF 68.1 K 500 MW F+-1%	16299	CGW RN55D 6812 F
R 149	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 150	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 151	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 152	12127640A	RFF 56.2 K 1.0 MW F+- 1%	16299	CCPNING NA 65
R 153	12124400A	RFF 26.1 K 500 MW F+-1%	16299	CGW RN55D 2612 F
R 154	12123560A	RFF 3.83K 500 MW F+-1%	16299	CGW RN55D 3831 F
R 155	12124240A	RFF 17.8 K 500 MW F+-1%	16299	CGW RN55D 1782 F
R 156	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 157	12127640A	RFF 56.2 K 1.0 MW F+- 1%	16299	CCPNING NA 65
R 158	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 159	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 160	12127650A	RFF 10.0 K 3.0 W 5% METOX	16299	GGW FP-3 ADV.29481

TIMEBASE AND 'X' AMPLIFIER (SERIAL NO. PREFIX 040 AND 033) - Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 161	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 162	09100040A	RVF 100.0 0.5 W M	73128	HEL TYP 72PM
R 163	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 164	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 166	12123080A	RFF 1.21K 500 MW F +1%	16299	CGW RN55D 1211 F
R 167	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 168	12127650A	RFF 10.0 K 3.0 W 5% METOX	16299	GGW FP-3 ADV.29481
R 169	09100060A	PVC 1.0 K 0.5 WK +-10%	73128	HEL TYP 72PM
R 170	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 171	12127640A	RFF 56.2 K 1.0MW F+- 1%	16299	COFNING NA 65
R 172	12123160A	RFF 1.47K 500 MW F+-1%	16299	CGW RN55D 1471 F
R 173	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 174	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 175	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 176	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 177	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 178	12121400A	RFF 26.1 500 MW F+-1%	16299	CGW RN55D 2601 F
R 179	12125400A	RFF 261.0 K 500 MW F+-1%	16299	CGW RN55D 2613 F
R 180	12122400A	RFF 261.0 500 MW F+-1%	16299	CGW RN55D 2610 F
S 31	25100911A	SWC 3P3T SLIDE SWC	50423	
TR 101	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 102	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 103	10101080A	TRQ MPS2369 NPN	04712	MOTOROLA
TR 104	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 105	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1.200M 60
TR 106	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MCT 1.8 30M 40
TR 107	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MCT 1.8 30M 40
TR 108	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 109	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 110	10100010A	TRQ 2N2369 NPN 1 15 MT0-18	04713	MCT 1.2 500M 20
TR 111	10094730A	TRQ 2N3906 PNP 1 40 PTC-92	04713	MCT 1 200M 60
TR 112	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1 200M 60
TR 113	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MCT 1.8 30M 40
TR 114	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1 200M 60
TR 115	10100160A	TRQ 2N5058 NPN 1 300	07263	FCH 5 10
TR 116	10100160A	TRQ 2N5058 NPN 1 300	07263	FCH 5 10
TR 117	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1 200M 60
'Y' AMPLIFIER (SERIAL NO. PREFIX 040)				
C 201	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 202	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 204	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 205	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 206	07101800A	CCD 18.0pF 1.0 KVJ NPO	56289	SPRAGUE CO ODB 102F180J
C 207	07095760A	CCD 10NF 150 V T 40%	71590	CTL TYP DDM 103
C 208	07200020A	CCD 39.0pF 500V K +10%	71590	CTL DD-390
C 209	07300020A	CVCO 10.0-40pF TRIMMER	73445	ERIE 538-011D-9-35
C 210	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 211	07103600A	CVC 10-60pF 350.0 V N750	50423	
C 212	07101750A	CSF 180.0pF 500.0 V 5%	71590	CTL TYPE CPR-180J
C 214	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DC-680
C 215	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 217	07022580A	CMM 390 PF 500 V J 5%	84171	ARCO TYPE CM-15-F-351-J
C 218	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DC-680
C 219	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 220	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 221	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 222	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 224	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 225	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1

'Y' AMPLIFIER (SERIAL NO. PREFIX 040) -- Continued

SCHEMATIC REF		BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C	226	07100850A	CCD 22.0pF 500.0 VJ NPO	90201	RMC TYPE CG NPO
C	227	07101980A	CCD 100.0 NF 25.0 V NPO	56289	SPRAG CO 69A250M1042 OR EQ.
C	228	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	229	07200140A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C	230	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DCM 103
C	231	07200090A	CCD 15.0PF 500.0 VJ +- 5%	50423	SEE 07-02241-0A
C	232	07200190A	CCD 15.0PF 500.0 VJ +- 5%	50423	SEE 07-02241-0A
C	234	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DCM 103
C	235	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DCM 103
C	236	07101800A	CCD 18.0pF 1.0 KVJ NPO	56289	SPRAGUE CO ODB 102F180J
C	237	07100860A	CCD 68.0pF 500 V	90201	RMC TYPE CG
C	238	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C	239	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DCM 103
C	240	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DCM 103
C	241	07100840A	CCD 15.0pF 500 V	90201	RMC TYPE CG
C	242	07100840A	CCD 15.0pF 500 V	90201	RMC TYPE CG
C	243	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C	244	07095730A	CCD 330 PF 500 V K 10%	71590	CTL TYP CF-331
C	245	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C	246	07095580A	CCD 23.0PF 500.0VK +-10%	56289	SPG TYP CC30B102G330K
C	247	07100680A	CSF 120.0pF 50.0 V K	25085	SIEMANS B31110A050120K
C	248	07100680A	CSF 120.0pF 50.0 V K	25085	SIEMANS B31110A050120K
C	249	07200070A	CCD 56.0pF 500.0 V K +-10%	71590	CTL DD-560
C	250	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C	251	07101320A	CEA 10.0UF 25.0 VT +75,-10	56289	SPRAGUE TE1204 STYL 30D
C	253	07100010A	CMB 3.3NF 500.0 V K SILVRD	72982	ERI 63300418A0332K
C	254	07101980A	CCD 100.0NF 25.0 V NPO	56289	SPRAG CO69A250M1042 or EQ.
C	522	07025410A	CCD 10 NF 500 V	56289	SPRAGUE TYPE 19C241 DISC
C	524	07025410A	CCD 10 NF 500 V	56289	SPRAGUE TYPE 19C241 DISC
C	526	07102390A	CSM 470.0PF 33.0 VJ POLYSTY	26625	MIAL TYPE 611
C	528	07102390A	CSM 470.0PF 33.0 VJ POLYSTY	26625	MIAL TYPE 611
D	201	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D	202	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D	203	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	204	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	205	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	206	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	207	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	208	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	209	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	210	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	211	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	212	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	213	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	214	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D	215	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D	216	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D	217	05079100A	DZP 1N 957B 6.8 18M	27832	FCH SI D07 ZENER DIODE
D	218	05079100A	DZP 1N 957B 6.8 18M	27832	FCH SI D07 ZENER DIODE
D	219	05079200A	DGP 1N4148 75 10M	07263	FCH SI D035
D	220	05100490A	DGP 1N4148 100 10M	01295	TI SI D0 35 4 5 JAN
D	221	05079100A	DZP 1N957B 6.8 V 18M	27832	FCH SI D0 7 ZENER DIODE
L	201	03100480A	CRF 22UH 50 MA	76493	J.W.Miller 70F225A1
L	202	03100480A	CRF 22UH 50 MA	76493	J.W.Miller 70F225A1
L	203	46100000A	FRB FERRITE BEAD	78488	STACKPOLF 57-0180-7D MAT
L	204	46100000A	FRB FERRITE BEAD	78488	STACKPOLF 57-0180-7D MAT
R	201	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R	202	09100870A	PVC 22.0 K 0.5W R202 R52	50423	ADV. A4/32894 1010A
R	203	12124880A	RFF 82.5 K 500 MW F+-1%	16299	CGW RN55D 8252 F
R	204	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R	205	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R	206	12124520A	RFF 34.8 K 500 MW F+-1%	16299	CGW RN55D 3482 F
R	207	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F

‘Y’ AMPLIFIER (SERIAL NO. PREFIX 040) – Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 208	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 209	12123300A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 210	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 211	12123280A	RFF 1.96K 500 MW F+-1%	16299	CGW RN55D 1961 F
R 212	12121240A	RFF 17.8 500 MW F+-1%	16299	CGW RN55D 1788 F
R 213	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 214	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
P 215	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 216	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 217	12122240A	RFF 178.0 500 MW F+-1%	16299	CGW RN55D 1780 F
R 218	12125400A	RFF 261.0 K 500 MW F+-1%	16299	CGW RN55D 2613 F
R 219	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 220	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1080 F
R 221	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 4785 F
R 222	09100040A	RVF 100.0 0.5 W M	73138	HEL TYP 72PM
R 223	12122560A	RFF 383.0 500 MW F +1%	16299	CGW RN55D 38 30 F
R 224	12123720A	RFF 5.62K 500 MW F +1%	16299	CGW RN55D 5621 F
R 225	12121560A	RFF 38.3 500 MW F +1%	16299	CGW RN55D 38R3 F
R 226	12123320A	RFF 2.15K 500 MW F +1%	16299	CGW RN55D 2151 F
R 227	12122640A	RFF 464.0 500 MW F +1%	16299	CGW RN55D 4640 F
R 228	12122640A	RFF 464.0 500 MW F +1%	16299	CGW RN55D 4640 F
R 229	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1080 F
R 230	12127610A	PFF 3.0 K 6.0 W 5% METCX	00327	WELWYN F76 ADV.33212
R 231	12121400A	RFF 26.1 500 MW F +1%	16299	CGW RN55D 26R1 F
R 232	12121800A	RFF 68.1 500 MW F +1%	16299	CGW RN55D 68R1 F
R 233	12122000A	RFF 100.0 500 MW F +1%	16299	CGW RN55D 1000 F
R 234	12122080A	RFF 121.0 500 MW F+-1%	16299	CGW RN55D 1210 F
R 235	12122400A	RFF 261.0 500 MW F +1%	16299	CGW RN55D 2610 F
R 236	12124000A	RFF 10.0K 500 MW F -1%	16299	CGW RN55D 1002 F
R 237	12122160A	RFF 147.0 500 MW F +1%	16299	CGW RN55D 1470 F
R 238	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 4785 F
R 239	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1080 F
R 240	12127610A	RFF 3.0 K 6.0 W 5% METCX	00327	WELWYN F76 ADV.33212
R 241	12122640A	RFF 464.0 500 MW F +1%	16299	CGW RN55D 4640 F
R 242	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 243	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1080 F
R 244	12122720A	RFF 562.0 500 MW F+-1%	16299	CGW RN55D 5620 F
R 245	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 246	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 247	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 248	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 249	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 4785 F
R 250	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1080 F
R 251	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 252	09100870A	RVC 22.0 K 0.5W R 207 R52	50423	ADV. A4/32894 1010A
R 253	12124880A	RFF 82.5 K 500 MW F+-1%	16299	CGW RN55D 8252 F
R 254	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 255	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 256	12124520A	RFF 34.8 K 500 MW F+-1%	16299	CGW RN55D 3482 F
R 257	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 258	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 259	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 260	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 261	12123280A	RFF 1.96K 500 MW F+-1%	16299	CGW RN55D 1961 F
R 262	12121240A	RFF 17.8 500 MW F+-1%	16299	CGW RN55D 1788 F
R 263	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 264	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 265	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 266	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 267	12122240A	RFF 178.0 500 MW F+-1%	16299	CGW RN55D 1780 F

'Y' AMPLIFIER (SERIAL NO. PREFIX 040) - Continued

SCHEMATIC REF		BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 268	12125400A	RFF 261.0 K 500	MW F+-1%	16299	CGW RN55D 2613 F
R 269	12124160A	RFF 14.7 K 500	MW F+-1%	16299	CGW RN55D 1472 F
P 270	12121000A	RFF 10.0 500	MW F+-1%	16299	CGW RN55D 1000 F
R 271	12123800A	RFF 6.81K 500	MW F+-1%	16299	CGW RN55D 6811 F
R 272	12121640A	RFF 46.4 500	MW F+-1%	16299	CGW RN55D 47R5 F
R 273	12123280A	RFF 1.96K 500	MW F+-1%	16299	CGW RN55D 1961 F
R 274	12123080A	RFF 1.21K 500	MW F+-1%	16299	CGW RN55D 1211 F
R 275	12121000A	RFF 10.0 500	MW F+-1%	16299	CGW RN55D 1000 F
R 276	12124320A	RFF 21.5 K 500	MW F+-1%	16299	CGW RN55D 2152 F
R 277	12123240A	RFF 1.78K 500	MW F+-1%	16299	CGW RN55D 1781 F
R 278	12123400A	RFF 2.61K 500	MW F+-1%	16299	CGW RN55D 2611 F
R 279	12123240A	RFF 1.78K 500	MW F+-1%	16299	CGW RN55D 1781 F
R 280	12124160A	RFF 14.7 K 500	MW F+-1%	16299	CGW RN55D 1472 F
R 281	12124320A	RFF 21.5 K 500	MW F+-1%	16299	CGW RN55D 2152 F
R 282	12124320A	RFF 21.5 K 500	MW F+-1%	16299	CGW RN55D 2152 F
R 283	12124160A	RFF 14.7 K 500	MW F+-1%	16299	CGW RN55D 1472 F
R 284	12124320A	RFF 21.5 K 500	MW F+-1%	16299	CGW RN55D 2152 F
R 285	12123000A	RFF 1.0 K 500	MW F+-1%	16299	CGW RN55D 1001 F
R 286	12123560A	RFF 3.83K 500	MW F+-1%	16299	CGW RN55D 3831 F
R 287	12124400A	RFF 26.1 K 500	MW F+-1%	16299	CGW RN55D 2612 F
R 288	12123240A	RFF 1.78K 500	MW F+-1%	16299	CGW RN55D 1781 F
R 289	12123640A	RFF 4.64K 500	MW F+-1%	16299	CGW RN55D 4641 F
R 290	12123800A	RFF 6.81K 500	MW F+-1%	16299	CGW RN55D 6811 F
R 291	12124000A	RFF 10.0 K 500	MW F+-1%	16299	CGW RN55D 1002 F
R 292	12124400A	RFF 26.1 K 500	MW F+-1%	16299	CGW RN55D 2612 F
R 293	12124520A	RFF 34.8 K 500	MW F+-1%	16299	CGW RN55D 3482 F
R 294	12123800A	RFF 6.81K 500	MW F+-1%	16299	CGW RN55D 6811 F
R 295	12123720A	RFF 5.62K 500	MW F+-1%	16299	CGW RN55D 5621 F
R 296	09100660A	RVF 100.0 K .5 W +-10%		73138	HELIPOCT 72P TRIMPOT MINI
R 297	12121720A	RFF 56.2 500	MW F+-1%	16299	CGW RN55D 56R2 F
R 298	12122400A	RFF 261.0 500	MW F+-1%	16299	CGW RN55D 2610 F
R 299	12125520A	RFF 348.0 K 500	MW F+-1%	16299	CGW RN55D 3483 F
R 524	12125640A	RFF 464.0 K 500	MW F+-1%	16299	CGW RN55D 4643 F
R 525	12127910A	RFF 1.0 M 500.0MW +-0.5%		16299	CGW NA65 CR ADV26346
R 528	12125640A	RFF 464.0 K 500	MW F+-1%	16299	CGW RN55D 4643 F
R 529	12127910A	RFF 1.0 M 500.0MW +-0.5%		16299	CGW NA65 CR ADV26346
R 554	12121320A	RFF 21.5 500	MW F+-1%	16299	CGW RN55D 21R5 F
R 555	12121320A	RFF 21.5 500	MW F+-1%	16299	CGW RN55D 21R5 F
P 581	12123640A	RFF 4.64K 500	MW F+-1%	16299	CGW RN55D 4641 F
R 582	12121000A	RFF 10.0 500	MW F+-1%	16299	CGW RN55D 10R0 F
R 595	12123720A	RFF 5.62K 500	MW F+-1%	16299	CGW RN55D 5621 F
R 596	09100660A	RVF 100.0 K .5 W +-10%		73138	HELIPOCT 72P TRIMPOT MINI
R 597	12121720A	RFF 56.2 500	MW F+-1%	16299	CGW RN55D 56R2 F
R 598	12122400A	RFF 261.0 500	MW F+-1%	16299	CGW RN55D 2610 F
R 599	12125520A	RFF 348.0 K 500	MW F+-1%	16299	CGW RN55D 3483 F
TR 201	10101260A	TRQ WD406 DUAL N CHAN FET		50423	
TR 202	10101260A	TRQ WD406 DUAL N CHAN FET		50423	
TR 203	10101071A	TRQ AF33 MATCHED PAIR NPNPNP		50423	
TR 204	10101071A	TRQ AF33 MATCHED PAIR NPNPNP		50423	
TR 205	10079340A	TRQ 2N3640 PNP 1 12 PTO-18		07263	FCH .500 300M 30
TR 206	10079340A	TRQ 2N3640 PNP 1 12 PTO-18		07263	FCH .500 300M 30
TR 207	10100430A	TRQ 2N3904 NPN 1 40 PTO-92		04713	MCT 1 300M 40
TR 208	10100010A	TRQ 2N2369 NPN 1 15 MTO-18		04713	MCT 1.2 500M 20
TR 209	10100910A	TRQ 2N2369 NPN 1 15 MTO-18		04713	MCT 1.2 500M 20
TR 210	10100560A	TRQ MP5U04 NPN 1 180 P15202		04713	MCT 10 100M 40
TR 211	10100560A	TRQ MP5U04 NPN 1 180 P15202		04713	MCT 10 100M 40
TR 212	10101260A	TRQ WD406 DUAL N CHAN FET		50423	
TR 213	10101260A	TRQ WD406 DUAL N CHAN FET		50423	
TR 214	10101071A	TRQ AF33 MATCHED PAIR NPNPNP		50423	
TR 215	10079340A	TRQ 2N3640 PNP 1 12 PTO-18		07263	FCH .500 300M 30

'Y' AMPLIFIER (SERIAL NO. PREFIX 040) - Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
TR 216	10079340A	TRQ 2N3640 PNP 1 12 PTO-18	07263	FCH .500 300M 30
TP 217	10100020A	TPQ 2N 930 NPN 1 45 MTO-18	04713	MOT 1.8 30M 40
TR 218	10101080A	TRQ MPS2369 NPN	04713	MCTCRCLA
TR 219	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 220	10094730A	TRQ 2N3906 PNP 1 40 PTO-92	04713	MOT 1 200M 60
TR 221	10094730A	TRQ 2N3906 PNP 1 40 PTO-92	04713	MOT 1 200M 60
TR 222	10101071A	TRQ AE33 MATCHED PAIR NPNPNP	50423	
TR 227	10094730A	TRQ 2N 3906 PNP	50423	

'Y' AMPLIFIER (SERIAL NO. PREFIX 033)

C 201	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 202	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 204	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 205	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 206	07200060A	CCD 22.0PF 500.0 VK N330	71590	CTL DD-220
C 207	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 208	07200020A	CCD 39.0PF 500V K+-10%	71590	CTL DC-300
C 209	07300020A	CVC010.0-40PF TRIMMER	73445	ERIE 538-1110-9-35
C 210	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 211	07103600A	CVC 10-60PF 350.0 V N750	50423	STET-TRUSH IDSTRIK022
C 212	07100320A	CCD 220.0PF 1 KV DC	84171	ELMENCO TYPE CCD221
C 214	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DC-680
C 215	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 217	07022580A	CMM 390 PF 500 V J 5%	84171	APCO TYPE CM-15-E-391-J
C 218	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DD-680
C 219	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 220	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DC-470
C 221	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 222	07300000A	CVC000.8-6.8PF 400 V	80031	MEPCO 2222-802-2002 96056
C 224	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 225	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 226	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C 227	07101980A	CCD 100.0 NF 25.0 V NPO	56289	SPRAG CO 69A250M1042
C 228	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C 229	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DC-270
C 230	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 231	07200090A	CMD 15.0PF 500.0 VJ +- 5%	50423	SFF 07-02241-0A
C 232	07200090A	CMD 15.0PF 500.0 VJ +- 5%	50423	SEE 07-02241-0A
C 234	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 235	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 236	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DC-470
C 237	07100860A	CCD 68.0 PF 500 V	90201	RMC TYPE CG
C 238	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 239	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 240	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 241	07200080A	CCD 18.0PF 150.0 V	71590	CTL DC-180
C 242	07200080A	CCD 18.0PF 150.0 V	71590	CTL DD-180
C 243	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 244	07095730A	CCD 330 PF 500 V K 10%	71590	CTL TYP CE-331
C 245	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 246	07095580A	CCD 33.0PF 500.0VK +-10%	56289	SPG TYP C030P102G330K
C 247	07095590A	CCD 150 PF K 10%	84171	APC TYP CCD-151
C 248	07095590A	CCD 150 PF K 10%	84171	ARC TYP CCD-151
C 249	07200070A	CCD 56.0 PF 500 V K +-10%	71590	CTL DD-560
C 250	07200940A	CCD .1UF 25.0 V +-20%	91418	M25-1
C 251	07101320A	CFA 10. UF 25. VT +75,-10	56289	SPRAGUE TF1204 STYL 30P

'Y' AMPLIFIER (SERIAL NO. PREFIX 033) — Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 522	07025410A	CCD 10 MF 500 V	56289	SPRAGUE TYPE 19C241 DISC
C 524	07025410A	CCD 10 MF 500 V	56289	SPRAGUE TYPE 19C241 DISC
C 526	07102390A	CSM 470.0PF 33.0 VJ POLYSTR	26625	MTAL TYPE 611
C 528	07102390A	CSM 470.0PF 33.0 VJ POLYSTR	26625	MTAL TYPE 611
D 201	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D 202	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D 203	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 204	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 205	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 206	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 207	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 208	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 209	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 210	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 211	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 212	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 213	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 214	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 215	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D 216	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D 217	05079100A	DZP 1N 957R 6.8 18M	27832	FCH SI D07 ZENER DIODE
D 218	05079100A	DZP 1N 957R 6.8 18M	27832	FCH SI D07 ZENER DIODE
D 219	05079200A	DGP 1N4148 75 10M	07263	FCH SI D035
L 201	03100480A	CRF 22 UH 50 MA	76493	JW MILLER 70F225A1
L 202	03100480A	CRF 22 UH 50 MA	76493	JW MILLER 70F225A1
L 203	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 204	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
R 201	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 202	09100870A	RVC 22.0 K 0.5W R 202 R 52	50423	ADV. A4/32894 1010A
R 203	12124880A	RFF 82.5 K 500 MW F+-1%	16299	CGW RN55D 8252 F
R 204	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 205	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 206	12124520A	RFF 34.8 K 500 MW F+-1%	16299	CGW RN55D 3482 F
R 207	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 208	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 209	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 210	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 211	12123280A	RFF 1.96K 500 MW F+-1%	16299	CGW RN55D 1961 F
R 212	12121240A	RFF 17.8 500 MW F+-1%	16299	CGW RN55D 1788 F
R 213	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 214	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 215	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 216	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 217	12122240A	RFF 178.0 500 MW F+-1%	16299	CGW RN55D 1780 F
R 218	12125400A	RFF 261.0 K 500 MW F+-1%	16299	CGW RN55D 2613 F
R 219	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 220	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 221	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 222	09100040A	RVF 100.0 0.5 W M	73138	HEL TYP 72PM
R 223	12122560A	RFF 383.0 500 MW F+-1%	16299	CGW RN55D 3830F
R 224	12123720A	RFF 5.62K 500 MW F+-1%	16299	CGW RN55D 5621F
R 225	12121560A	RFF 38.3 500 MW F+-1%	16299	CGW RN55D 38R3F
R 226	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151F
R 227	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640F
R 228	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640F
R 229	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 230	12127610A	RFF 3.0 K 6.0 W 5% METOX	00327	WELBYN F76 ADV.33212
R 231	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F

'Y' AMPLIFIER (SERIAL NO. PREFIX 033) -- Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 232	12121800A	RFF 68.1 500 MW F+-1%	16299	CGW RN55D 68R1F
R 233	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000F
R 234	12122080A	RFF 121.0 500 MW F+-1%	16299	CGW RN55D 1210 F
R 235	12122880A	RFF 825.0 500 MW F+-1%	16299	CGW RN55D 8250 F
R 236	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 237	12122240A	RFF 178.0 500 MW F+-1%	16299	CGW RN55D 1780 F
R 238	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 239	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 10R0 F
R 240	12127610A	RFF 3.0 K 6.0 W 5% METOX	00327	WELWYN F76 ADV.33212
R 241	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640F
R 242	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 243	12121000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 10R0 F
R 244	12122720A	RFF 562.0 500 MW F+-1%	16299	CGW RN55D 5620 F
R 245	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 246	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 247	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 248	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 249	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 250	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 10R0 F
R 251	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F
R 252	09100870A	RVC 22.0 K 0.5W P202 P52	50422	ADV. A4/32894 1010A
R 253	12124880A	RFF 82.5 K 500 MW F+-1%	16299	CGW RN55D 8252 F
R 254	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 255	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 256	12124520A	RFF 34.8 K 500 MW F+-1%	16299	CGW RN55D 3482 F
R 257	12122000A	RFF 100.0 500 MW F+-1%	16299	CGW RN55D 1000 F
R 258	12122640A	RFF 464.0 500 MW F+-1%	16299	CGW RN55D 4640 F
R 259	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 260	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 261	12123280A	RFF 1.96K 500 MW F+-1%	16299	CGW RN55D 1961 F
R 262	12121240A	RFF 17.8 500 MW F+-1%	16299	CGW RN55D 17R8 F
R 263	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 264	12122320A	RFF 215.0 500 MW F+-1%	16299	CGW RN55D 2150 F
R 265	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 266	12123520A	RFF 3.48K 500 MW F+-1%	16299	CGW RN55D 3481 F
R 267	12122240A	RFF 178.0 500 MW F+-1%	16299	CGW RN55D 1780 F
R 268	12125400A	RFF 261.0 K 500 MW F+-1%	16299	CGW RN55D 2613 F
R 269	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 270	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 10R0 F
R 271	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 272	12121640A	RFF 46.4 500 MW F+-1%	16299	CGW RN55D 47R5 F
R 273	12123280A	RFF 1.96K 500 MW F+-1%	16299	CGW RN55D 1961 F
R 274	12123080A	RFF 1.21K 500 MW F+-1%	16299	CGW RN55D 1211 F
R 275	12121000A	RFF 10.0 500 MW F+-1%	16299	CGW RN55D 10R0 F
R 276	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 277	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 278	12123400A	RFF 2.61K 500 MW F+-1%	16299	CGW RN55D 2611 F
R 279	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 280	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 281	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 282	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 283	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 284	12124320A	RFF 21.5 K 500 MW F+-1%	16299	CGW RN55D 2152 F
R 285	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 286	12123560A	RFF 3.83K 500 MW F+-1%	16299	CGW RN55D 3831 F
R 287	12124400A	RFF 26.1 K 500 MW F+-1%	16299	CGW RN55D 2612 F
R 288	12123240A	RFF 1.78K 500 MW F+-1%	16299	CGW RN55D 1781 F
R 289	12123640A	RFF 4.64K 500 MW F+-1%	16299	CGW RN55D 4641 F
R 290	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811 F
R 291	12124000A	RFF 10.0 K 500 MW F+-1%	16299	CGW RN55D 1002 F

'Y' AMPLIFIER (SERIAL NO. PREFIX 033) — Continued

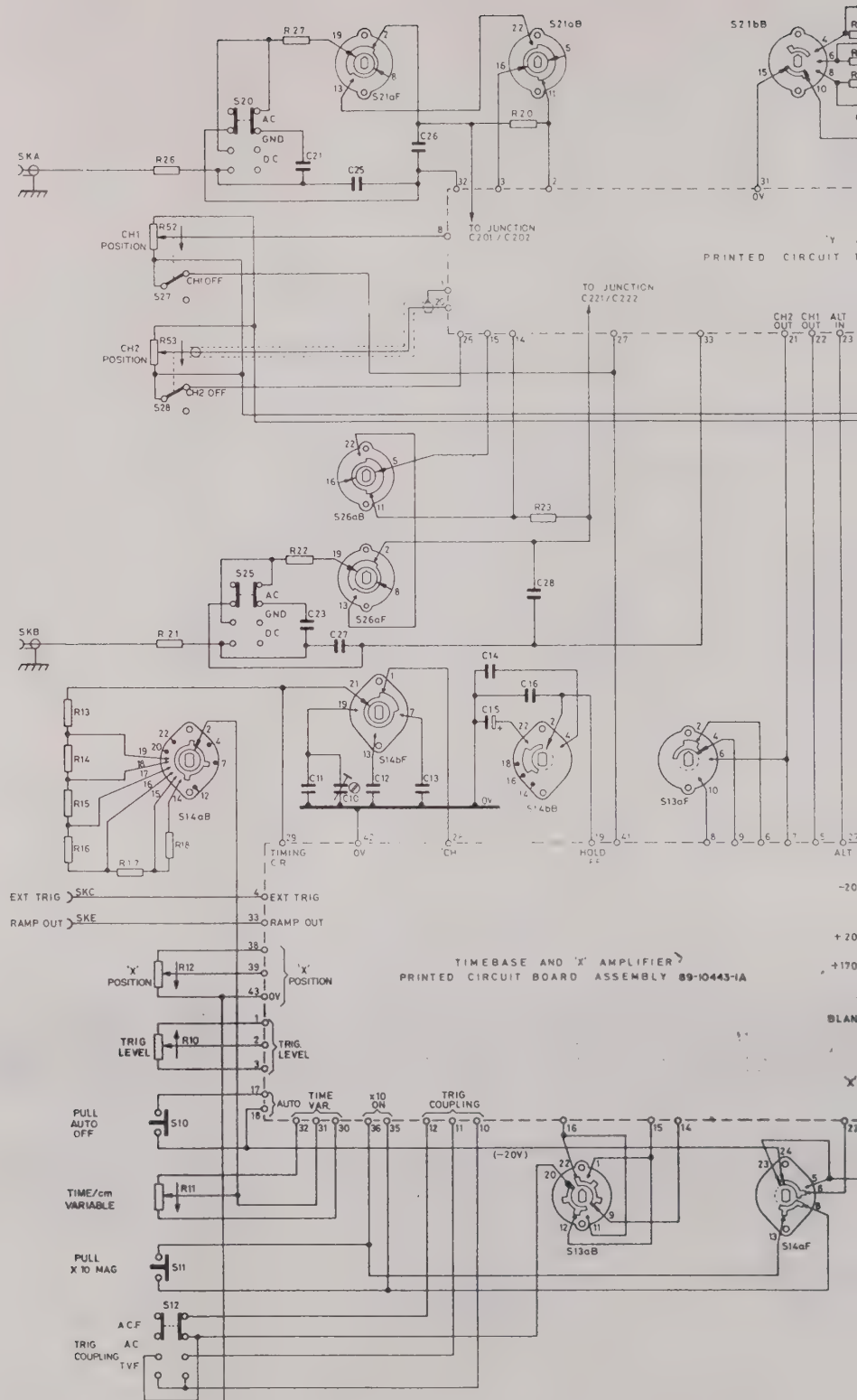
SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 292	12124400A	PFF 26.1 K 500 MW F+-1%	16299	CGW RN55D 2612 F
R 293	12124520A	PFF 34.8 K 500 MW F+-1%	16299	CGW RN55D 3482 F
R 294	12123800A	RFF 6.81K 500 MW F+-1%	16299	CGW RN55D 6811F
R 295	12123720A	PFF 5.62K 500 MW F+-1%	16299	CGW RN55D 5621 F
R 296	09100660A	PVF 100.0 K .5 W +-10%	73138	HELIPOT 72P TRIMPOT MINI
R 297	12121720A	PFF 56.2 500 MW F+-1%	16299	CGW RN55D 56R2 F
R 298	12122400A	RFF 261.0 500 MW F+-1%	16299	CGW RN55D 2610 F
R 299	12125520A	PFF 348.0 K 500 MW F+-1%	16299	CGW RN55D 3483 F
R 524	12125640A	PFF 464.0 K 500 MW F+-1%	16299	CGW RN55D 4643 F
R 525	12127910A	RFF 1.0 M 500.0MW +-0.5%	16299	CGW NA65 CR ADV26346
R 528	12125640A	RFF 464.0 K 500 MW F+-1%	16299	CGW RN55D 4643 F
R 529	12127910A	PFF 1.0 M 500.0MW +-0.5%	16299	CGW NA65 CR ADV26346
R 554	12121320A	PFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 555	12121320A	PFF 21.5 500 MW F+-1%	16299	CGW RN55D 21R5 F
R 581	12123640A	RFF 4.64K 500 MW F+-1%	16299	CGW RN55D 4641 F
R 595	12123720A	RFF 5.62K 500 MW F+-1%	16299	CGW RN55D 5621 F
R 596	09100660A	PVF 100.0 K .5 W +-10%	73138	HELIPOT 72P TRIMPOT MINI
R 597	12121720A	PFF 56.2 500 MW F+-1%	16299	CGW RN55D 56R2 F
R 598	12122400A	RFF 261.0 500 MW F+-1%	16299	CGW RN55D 2610 F
R 599	12125520A	PFF 348.0 K 500 MW F+-1%	16299	CGW RN55D 3483 F
TR 201	10101260A	TRQ WD406 DUAL N CHAN FET	50423	
TR 202	10101260A	TRQ WD406 DUAL N CHAN FET	50423	
TR 203	10101071A	TRQ AE33 MATCHED PAIR NPNPNP	50423	BLT ADV36704 1010
TR 204	10101071A	TRQ AE33 MATCHED PAIR NPNPNP	50423	BLT ADV36704 1010
TR 205	10079340A	TRQ 2N3640 PNP 1 12 PTO-1P	07263	FCH .500 300M 30
TR 206	10079340A	TPC 2N3640 PNP 1 12 PTO-18	07263	FCH .500 300M 30
TR 207	10100430A	TRQ 2N3904 NPN 1 40 PTO-92	04713	MCT 1 300M 40
TR 208	10100010A	TRQ 2N2369 NPN 1 15 MTO-18	04713	MOT 1.2 500M 20
TR 209	10100010A	TRQ 2N2369 NPN 1 15 MTO-18	04713	MOT 1.2 500M 20
TR 210	10100560A	TRQ MPS004 NPN 1 18C P15202	04713	MOT 10 100M 40
TR 211	10100560A	TRQ MPS004 NPN 1 18C P15202	04713	MOT 10 100M 40
TR 212	10101260A	TRQ WD406 DUAL N CHAN FET	50423	
TR 213	10101260A	TRQ WD406 DUAL N CHAN FET	50423	
TR 214	10101071A	TRQ AE33 MATCHED PAIR NPNPNP	50423	BLT ADV36704 1010
TR 215	10079340A	TRQ 2N3640 PNP 1 12 PTO-18	07263	FCH .500 300M 30
TR 216	10079340A	TRQ 2N3640 PNP 1 12 PTO-18	07263	FCH .500 300M 30
TR 217	10100020A	TRQ 2N 930 NPN 1 45 MTO-18	04713	MOT 1.8 30M 40
TR 218	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 219	10101080A	TRQ MPS2369 NPN	04713	MOTOROLA
TR 220	10094730A	TRQ 2N3906 PNP 1 40 PTO-92	04713	MOT 1 200M 60
TR 221	10094730A	TRQ 2N3906 PNP 1 40 PTO-92	04713	MOT 1 200M 60
TR 222	10101071A	TRQ AE33 MATCHED PAIR NPNPNP	50423	BLT ADV36704 1010
POWER SUPPLY (SERIAL NO. PREFIX 040 AND 033)				
C 301	07101490A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 302	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 303	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 304	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 305	07200120A	CCD 0.01UF 1.5KVK GMK	71590	CTL OC16-103
C 306	07200110A	CCD 4.7NF 4.0KVK 10%	91418	HI-KHI-V DISCAP GMV
C 307	07200110A	CCD 4.7NF 4.0KVK 10%	91418	HI-KHI-V DISCAP GMV
C 308	07200110A	CCD 4.7NF 4.0KVK 10%	91418	HI-KHI-V DISCAP GMV
C 309	07101490A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 310	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 311	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 312	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7

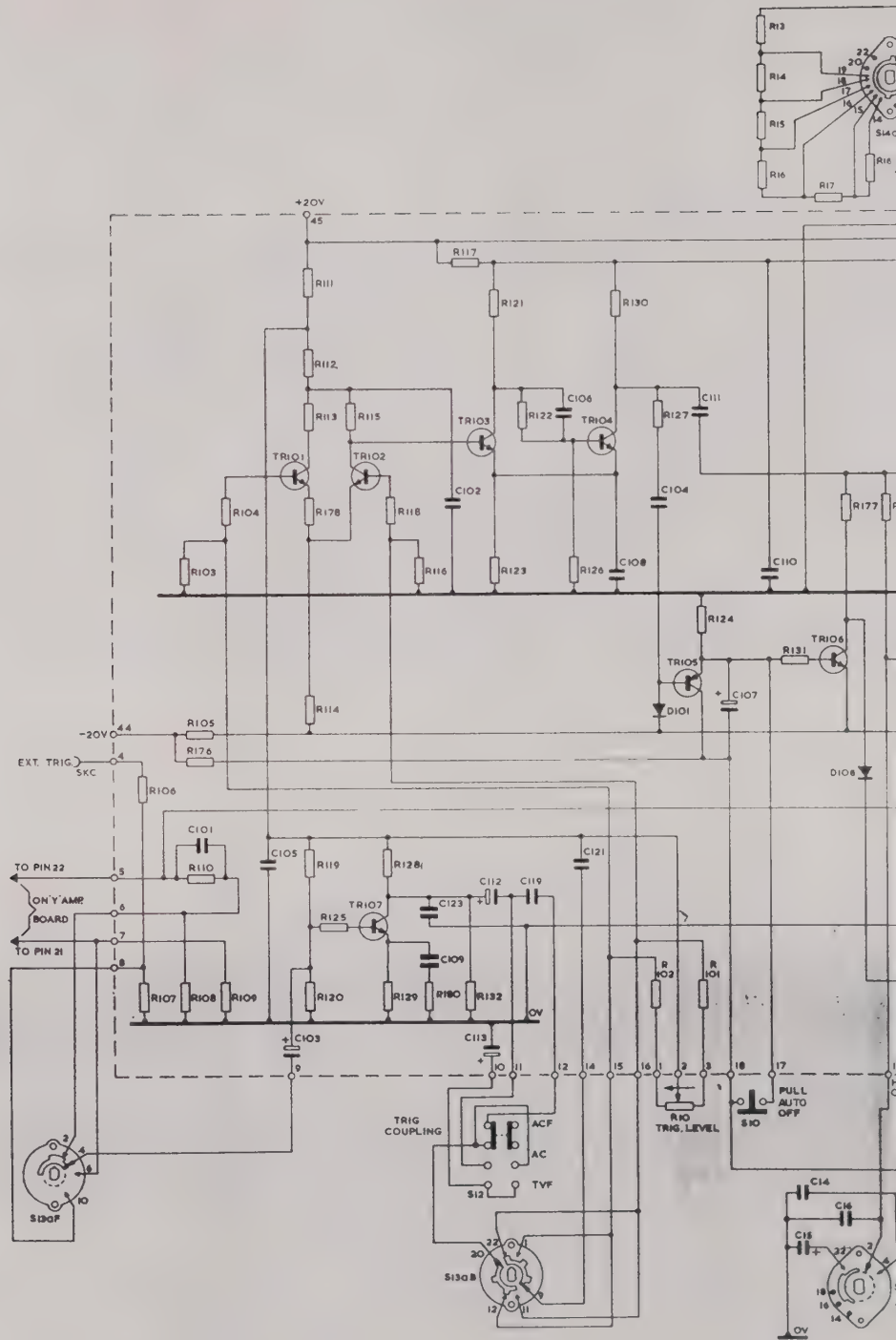
POWER SUPPLY (SERIAL NO. PREFIX 040 AND 033) - Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 313	07101560A	CCD 2.2NF 2.K V Z5U GMV	72982	ERIE 3888 Z5U 2.2NF GMV2K
C 314	07200120A	CCD 0.01UF 1.5KVK GMK	71590	CTL DC16-103
C 315	07101480A	CEA 4.0UF 450.0 V	56289	500D405F45CEH7
C 316	07100590A	CYF 4.7UF 100.0V M	34553	AMPEREX C280MAH/ANM7
C 317	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 318	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 319	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM 103
C 320	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DD-68C
D 301	05100460A	DRS MR995A 4 .25A	04713	MOT SI
D 302	05100460A	DRS MR995A 4 .25A	04713	MCT SI
D 303	05100460A	DRS MR995A 4 .25A	04713	MOT SI
D 304	05100110A	DGP 1N4007 1 1A	12954	DIC SI D041
D 305	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 306	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 307	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 308	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 309	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 310	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 311	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 312	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 313	05100490A	DGP 1N4148 100 10M	01295	TI SI D035 4 5 JAN
D 314	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
D 315	05079100A	DZP 1N 9578 6.8 18M	27832	FCH SI D07 ZENER DIODE
D 316	05079100A	DZP 1N 9578 6.8 18M	27832	FCH SI D07 ZENER DIODE
D 317	05100010A	DGP 1N3595 150 150M .5	12954	FCH SI D07 3 8
MR 301	05100060A	DGP WD4M 400 1.5A	04713	GJC
R 301	12123720A	RFF 5.62K 500 MW F+-1%	16299	CGW RN55D 5621 F
R 302	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 303	12123880A	RFF 8.25K 500 MW F+-1%	16299	CGW RN55D 8251 F
R 304	09100080A	RVC 10.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 305	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 306	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 307	12121880A	RFF 82.5 500 MW F+-1%	16299	CGW RN55D 82R5 F
R 308	12123000A	RFF 1.0 K 500 MW F+-1%	16299	CGW RN55D 1001 F
R 309	12011090A	RFC 5.6 500.0MW J+- 5%	01121	A-B TYP EB
R 310	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 311	12123120A	RFF 1.33K 500 MW F+-1%	16299	CGW RN55D 1331 F
R 312	12124160A	RFF 14.7 K 500 MW F+-1%	16299	CGW RN55D 1472 F
R 314	12011090A	RFC 5.6 500.0MW J+- 5%	01121	A-B TYP EB
R 315	12121880A	RFF 82.5 500 MW F+-1%	16299	CGW RN55D 82R5 F
R 316	12123320A	RFF 2.15K 500 MW F+-1%	16299	CGW RN55D 2151 F
R 317	12123120A	RFF 1.33K 500 MW F+-1%	16299	CGW RN55D 1331 F
R 318	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 319	12124600A	RFF 47.2 K 500 MW F+-1%	16299	CGW RN55D 4222 F
R 320	09100080A	RVC 10.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 321	12126160A	RFF 1.47M 500 MW F+-1%	16299	CGW RN55D 1474 F
R 322	12200000A	RFF 3.3 M 2.0 W 5% HISTB	00327	WELWYN TYPE DC-2
R 323	12127630A	RFC 2.2 M 600.0MW J+- 5%	01121	A-B TYPE EB OR EQUIV.
R 324	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 326	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 327	12124640A	RFF 46.4 K 500 MW F+-1%	16299	CGW RN55D 4642 F
R 328	12010800A	RFC 4.7 M 500 MW K+-10%	01121	A-B TYP EB
R 329	12125400A	RFF 261.0 K 500 MW F+-1%	16299	CGW RN55D 2613 F
R 331	12126160A	RFF 1.47M 500 MW F+-1%	16299	CGW RN55D 1474 F
R 332	09100090A	RVC 250.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 333	09100880A	RVC 500.0 K 0.5W 30% CERMET	73138	HELIPCT 72PM TRIMPOT MINI
R 334	12125000A	RFF 100.0 K 500 MW F+-1%	16299	CGW RN55D 1003 F
R 335	12127660A	RFF 27.0 K 2.0 W J+- 5%	16299	CORNING TYPE C425
R 336	12124170A	RFF 15.0 K 500 MW F+-1%	16299	CGW RN55D 1502 F
R 337	12124330A	RFF 22.1 K 500 MW F+-1%	16299	CGW RN55D 2212 F

POWER SUPPLY (SERIAL NO. PREFIX 040 AND 033) — Continued

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 338	12123640A	RFC 4.64K 500 MW F+-1%	16299	CGW PA55D 4641 F
R 339	12127630A	RFC 2.2 M 600.0MW J+- 5%	01121	A-B TYPE FB OR EQUIV.
R 341	12127630A	RFC 2.2 M 600.0MW J+- 5%	01121	A-B TYPE FB OR EQUIV.
R 342	12127630A	RFC 2.2 M 600.0MW J+- 5%	01121	A-B TYPE FB OR EQUIV.
TR 31	10100000A	TRQ MPS6519 PNP 1 25 PT0-92	04713	MOT 1 340M 250
TR 32	10100040A	TRQ MJE520 NPN 1 30 P77-03	04713	MOT 25 25
TR 301	10101250A	TRQ 2N6517 NPN 1 350 PTC-92	04713	MCTCRCLA .625 40M 30
TR 302	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MOT 1.8 30M 40
TR 303	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MOT 1.8 30M 40
TR 304	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1 200M 60
TR 305	10094730A	TRQ 2N3906 PNP 1 40 PT0-92	04713	MCT 1 200M 60
TR 306	10100020A	TRQ 2N 930 NPN 1 45 MT0-18	04713	MCT 1.8 30M 40
TR 307	10101000A	TRQ MPS2360 NPN	04713	MCTCRCLA
TR 308	10100110A	TRQ 2N5831 NPN 1 140 PT0-92	07263	FCH 1 100M 80
J 10	31100000A	REC AC POWER	82389	SWITCHCRAFT
T 31	20100241L	TRX 1010A POWER	50423	
--	33100000A	LNC LINE CORD SET 7 FT	70903	BELDEN BN772





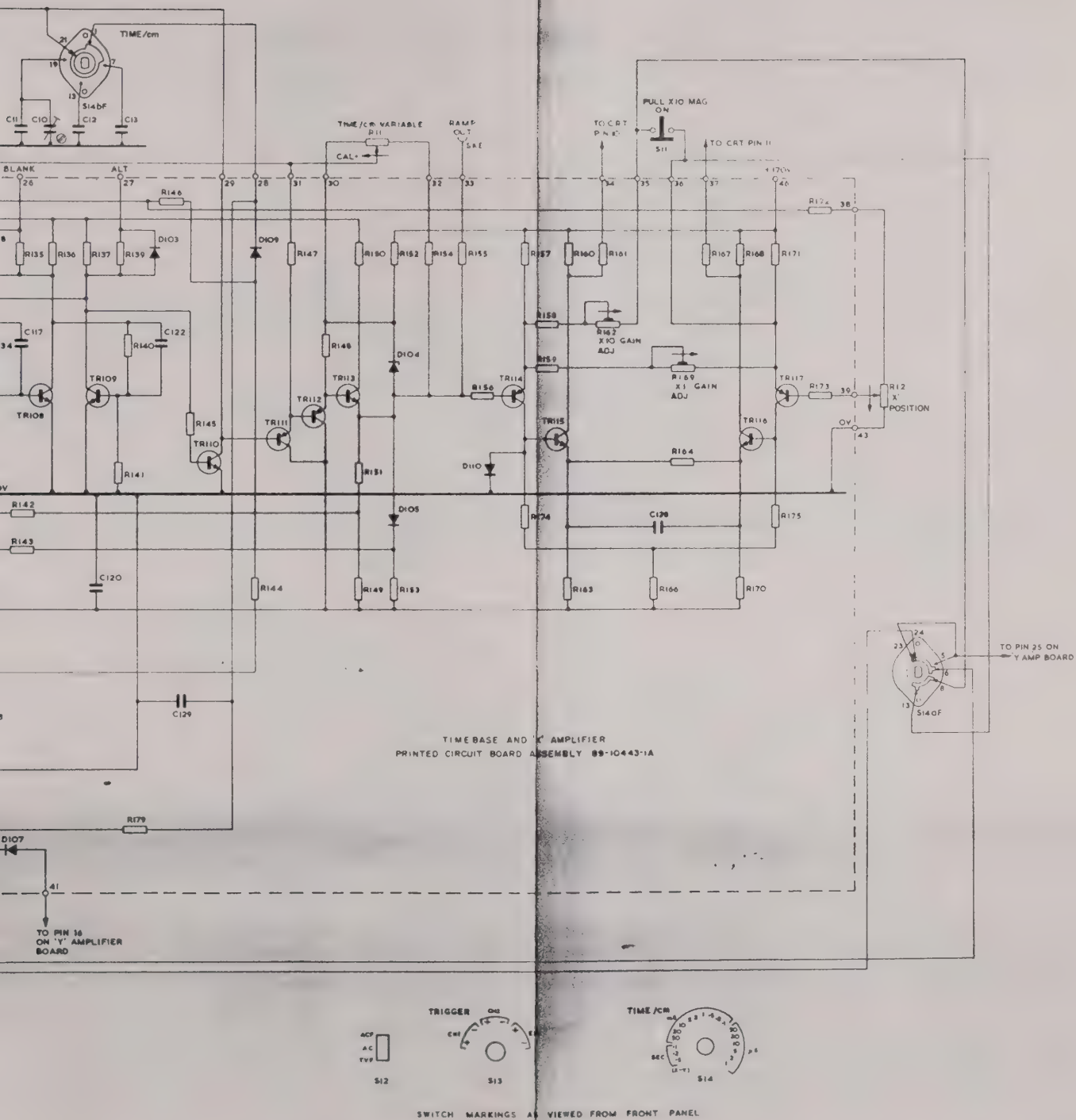
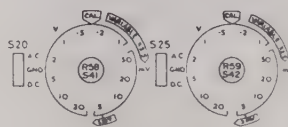
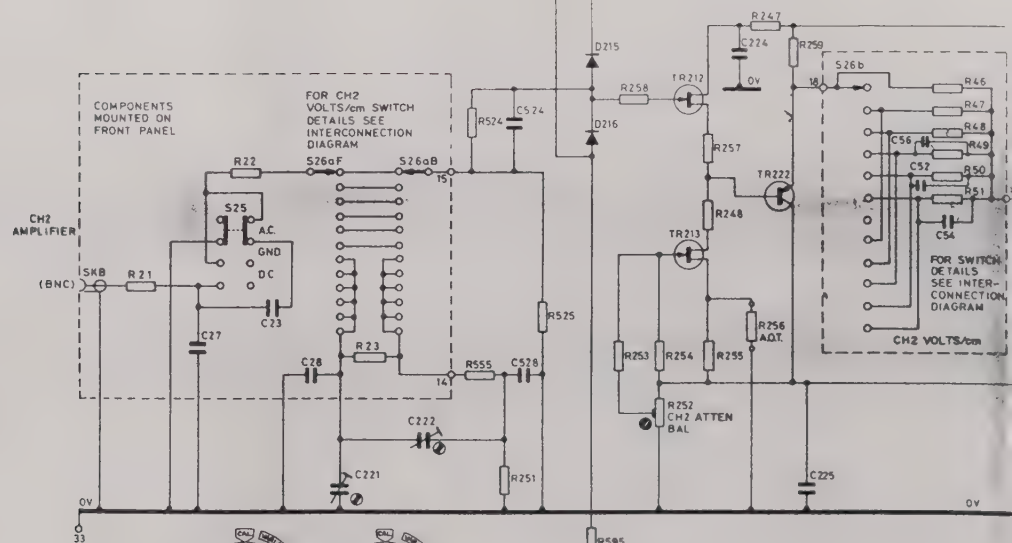
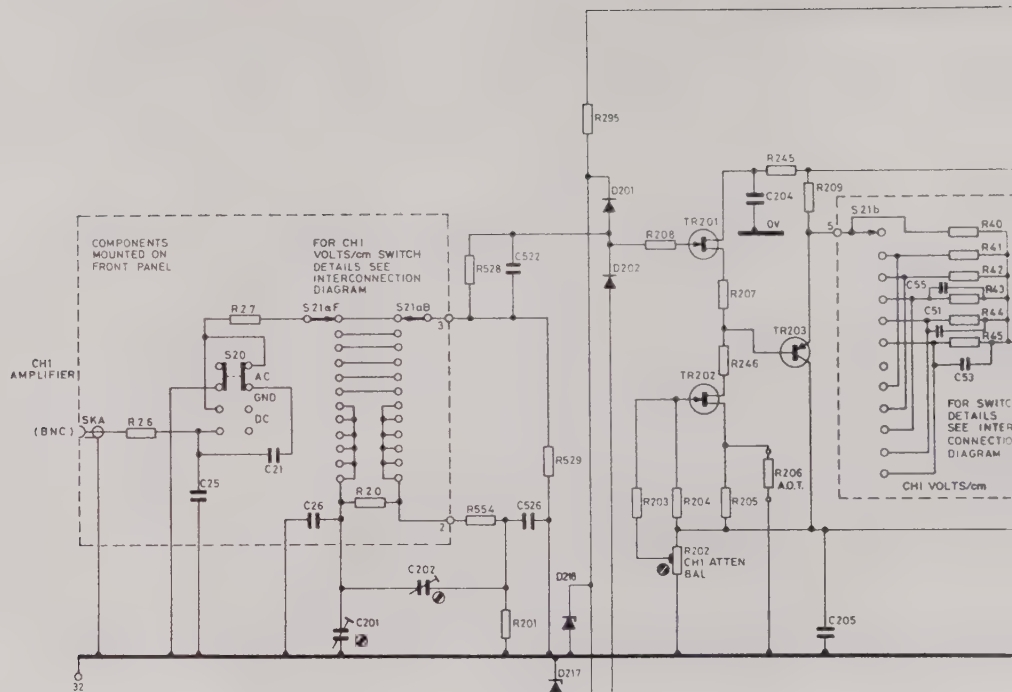


Figure 6-2. Timebase and 'X' Amplifier
(Serial No. Prefix 040 and 033)



NOTES

- 1 COMPONENTS CONTAINED WITHIN DOTTED LINES ARE NOT MOUNTED ON PRINTED CIRCUIT BOARD
- 2 A.O.T IS ADJUST ON TEST

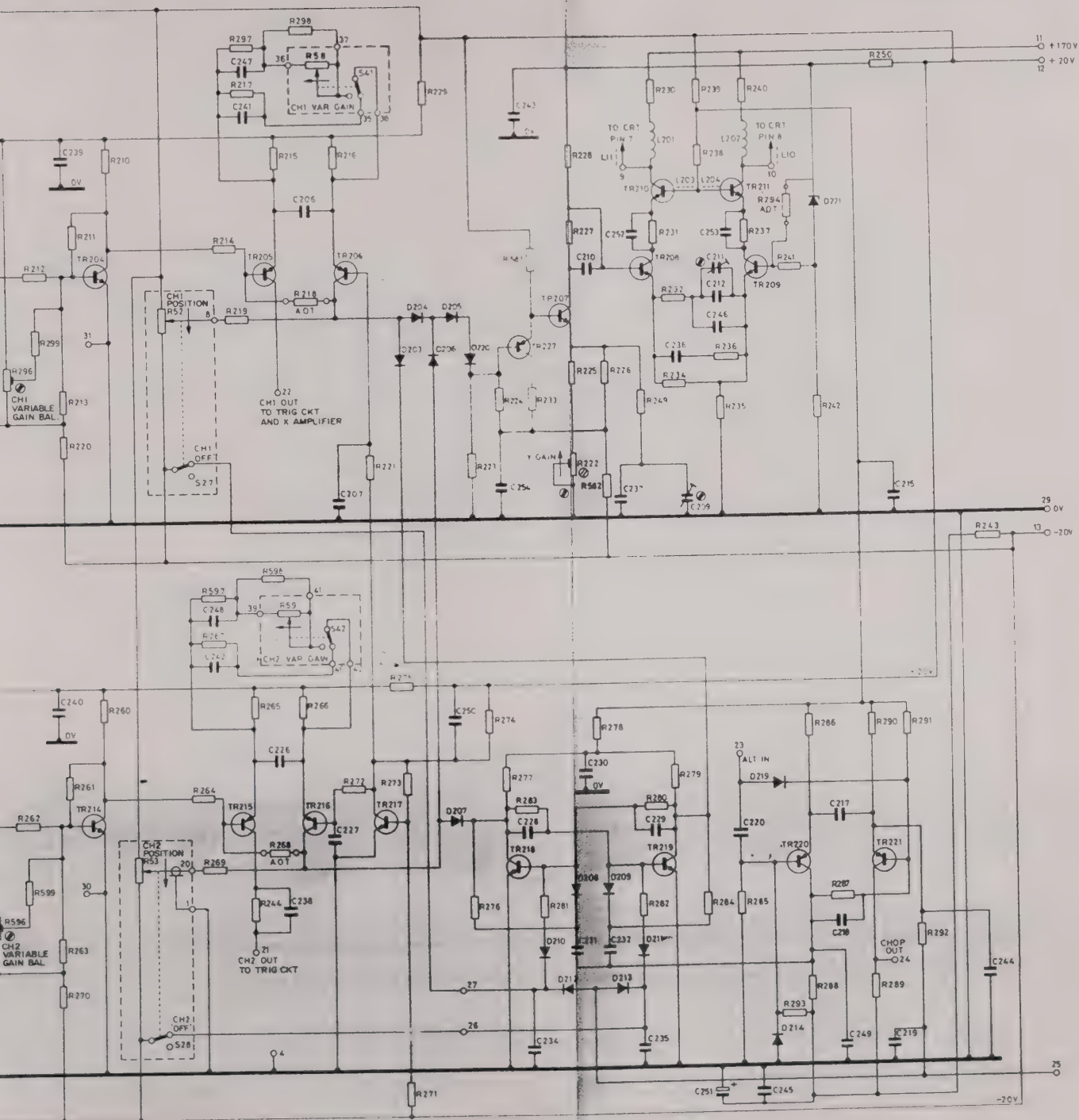
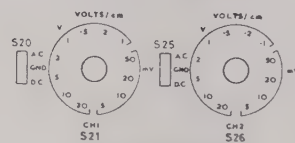
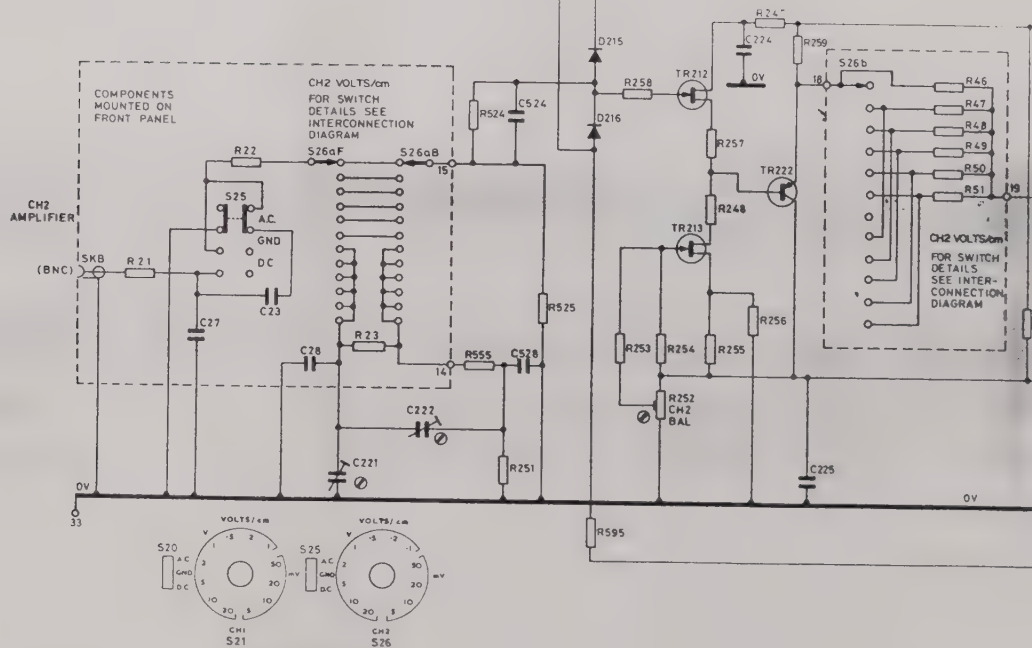
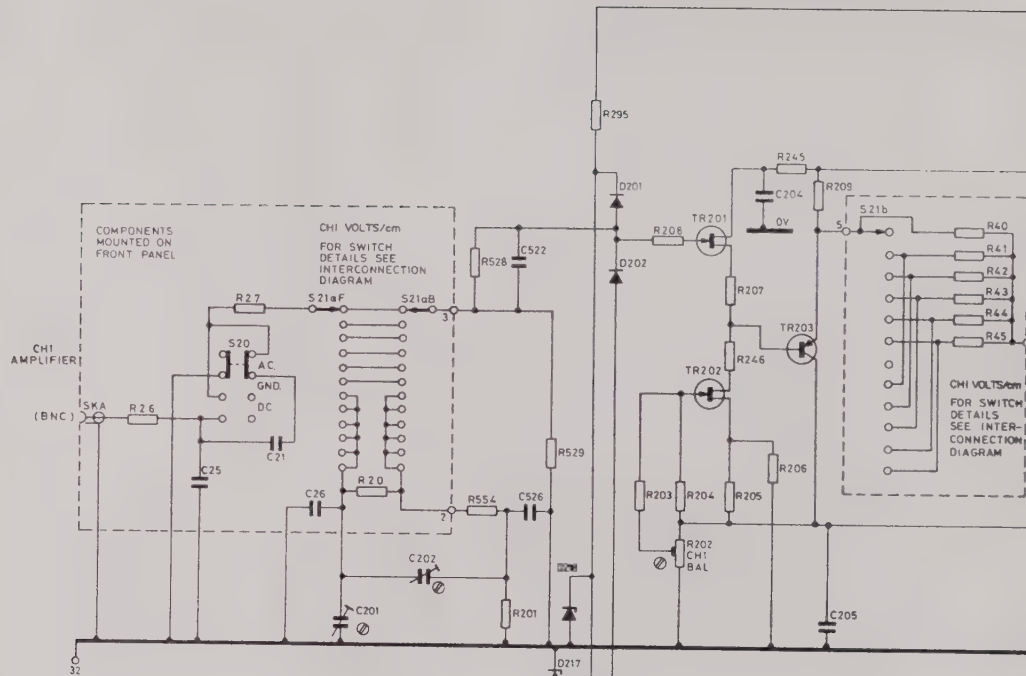


Figure 6-3. 'Y' Amplifier
(Serial No. Prefix 040)



SWITCH MARKINGS AS VIEWED FROM FRONT PANEL

- NOTES
 1. COMPONENTS CONTAINED WITHIN DOTTED LINES
 ARE NOT MOUNTED ON PRINTED CIRCUIT BOARD
 2. A.O.T. IS ADJUST ON TEST.

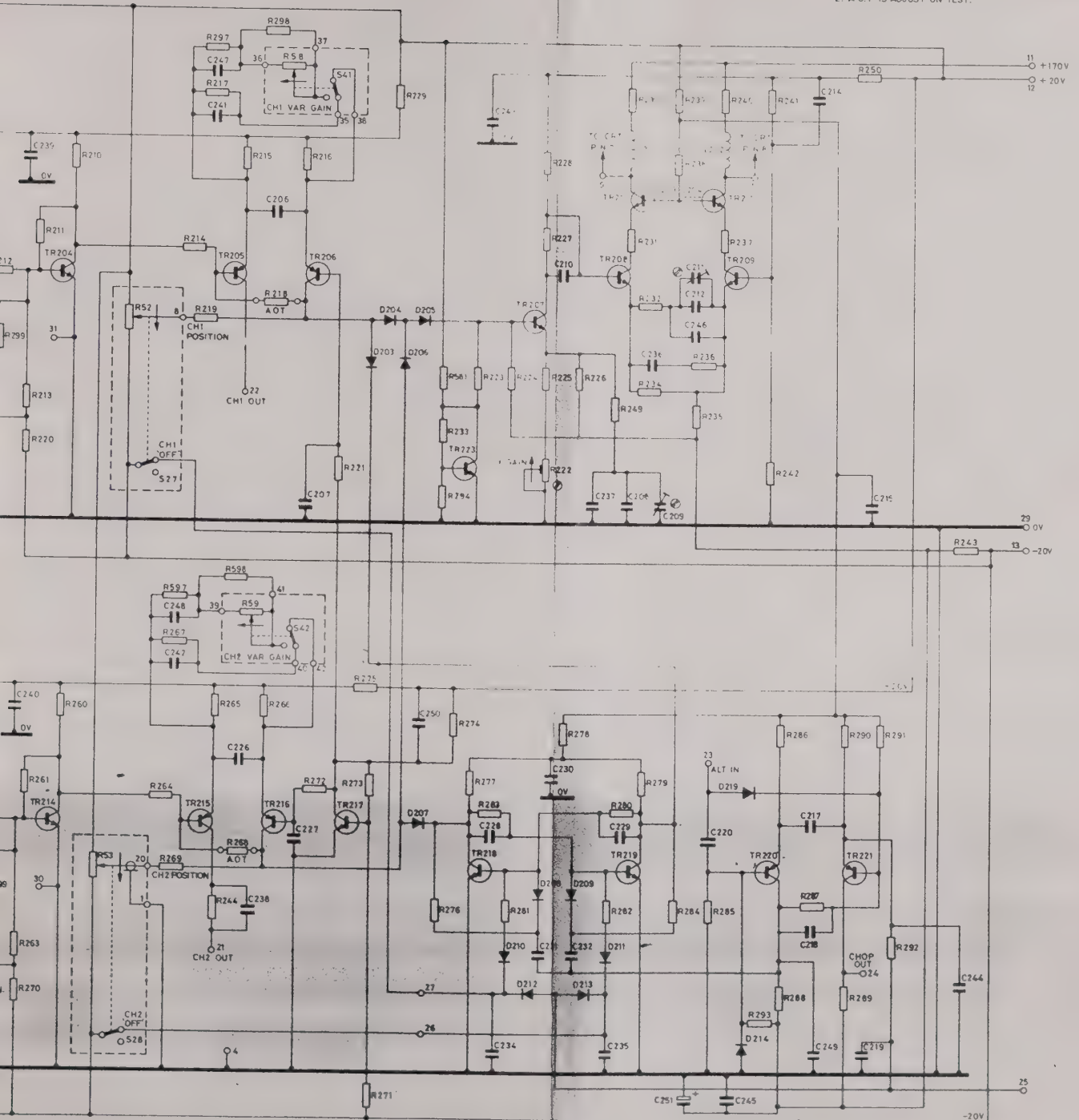
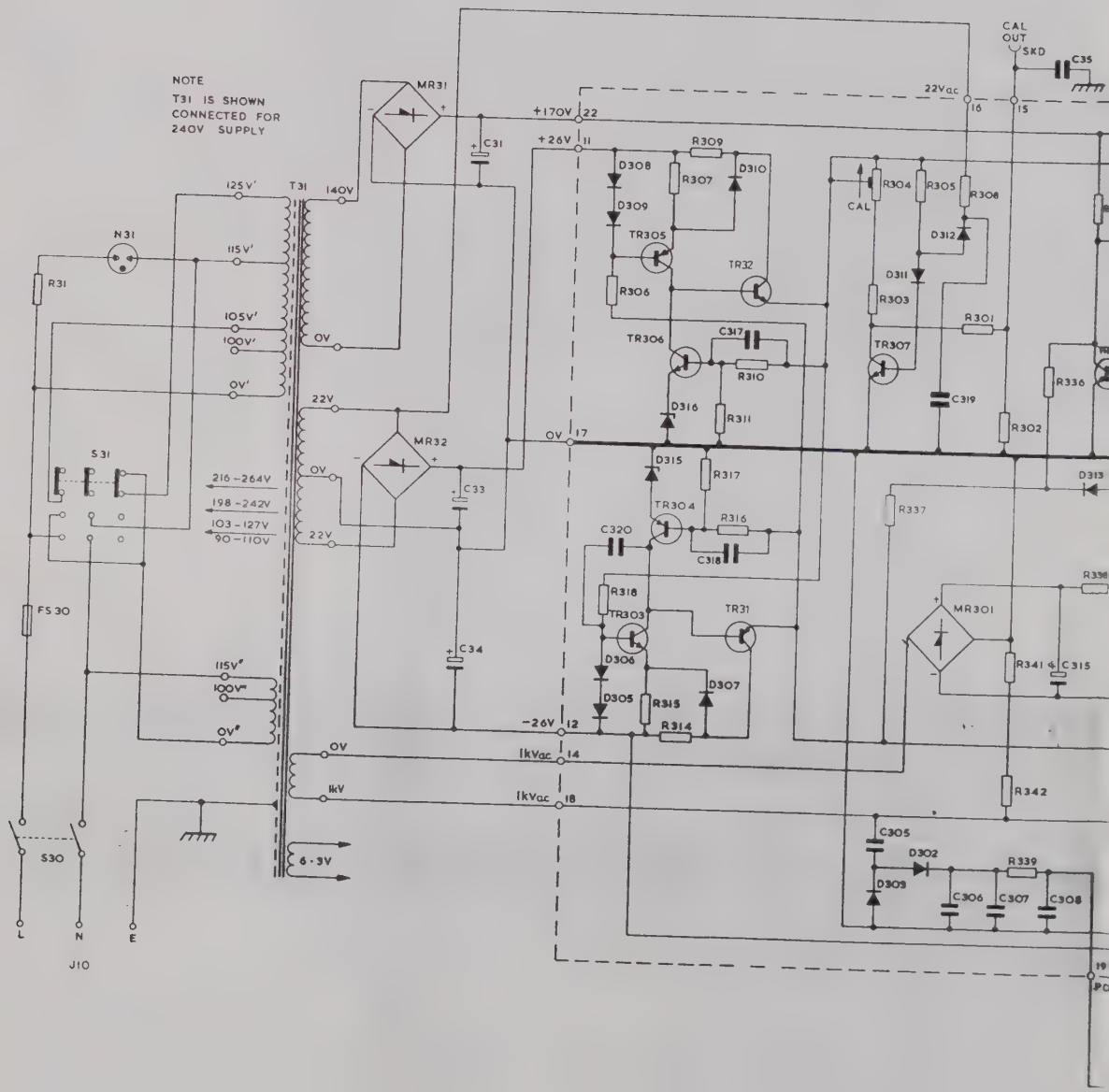
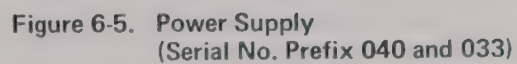


Figure 6-4. 'Y' Amplifier
 (Serial No. Prefix 033)



NOTE
T31 IS SHOWN
CONNECTED FOR
240V SUPPLY

1. COMPONENTS NOT ENCLOSED WITHIN THE DOTTED AREA ARE CALLED FOR ON INTERCONNECTION DIAGRAM AOISK2428



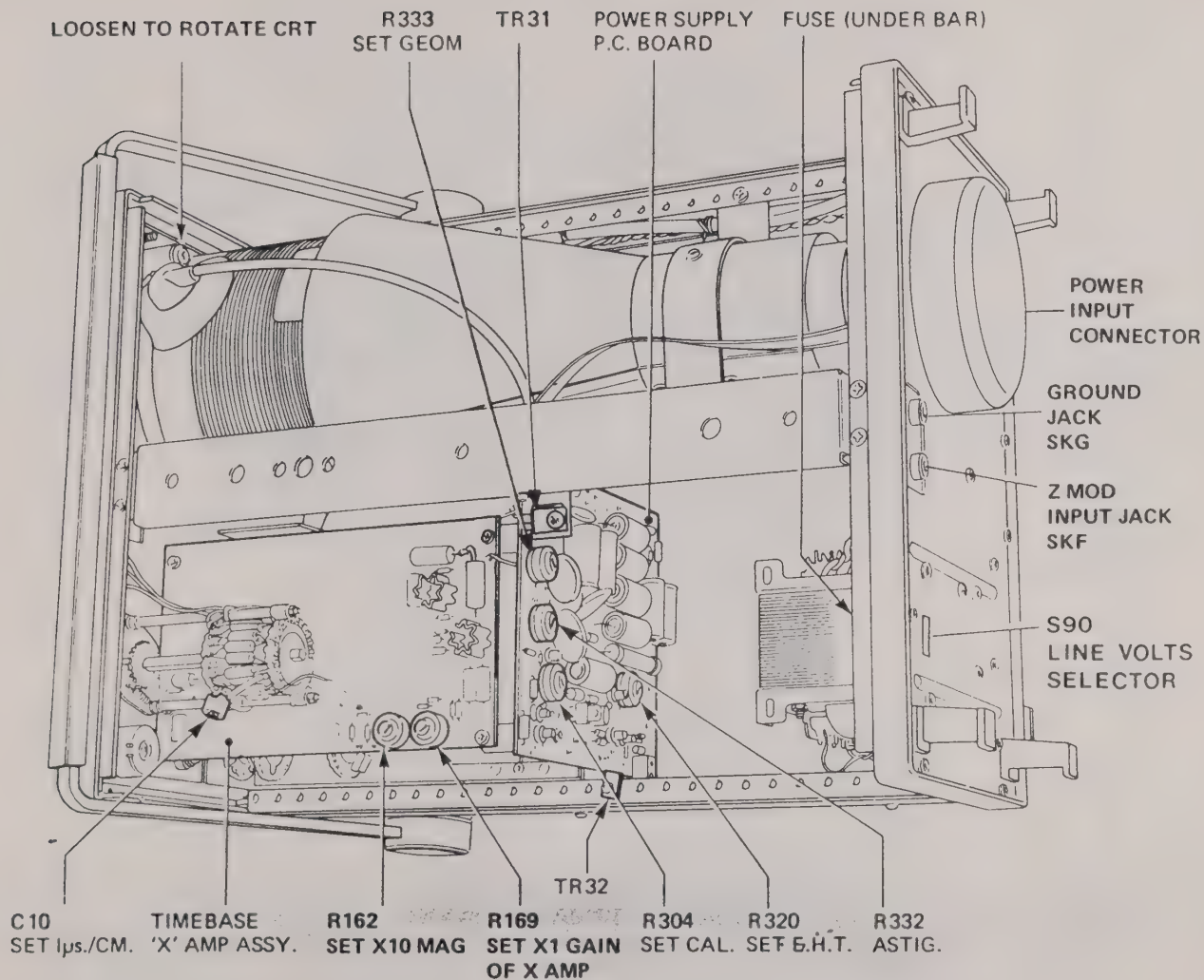


Figure 6-7. 1010A Top View

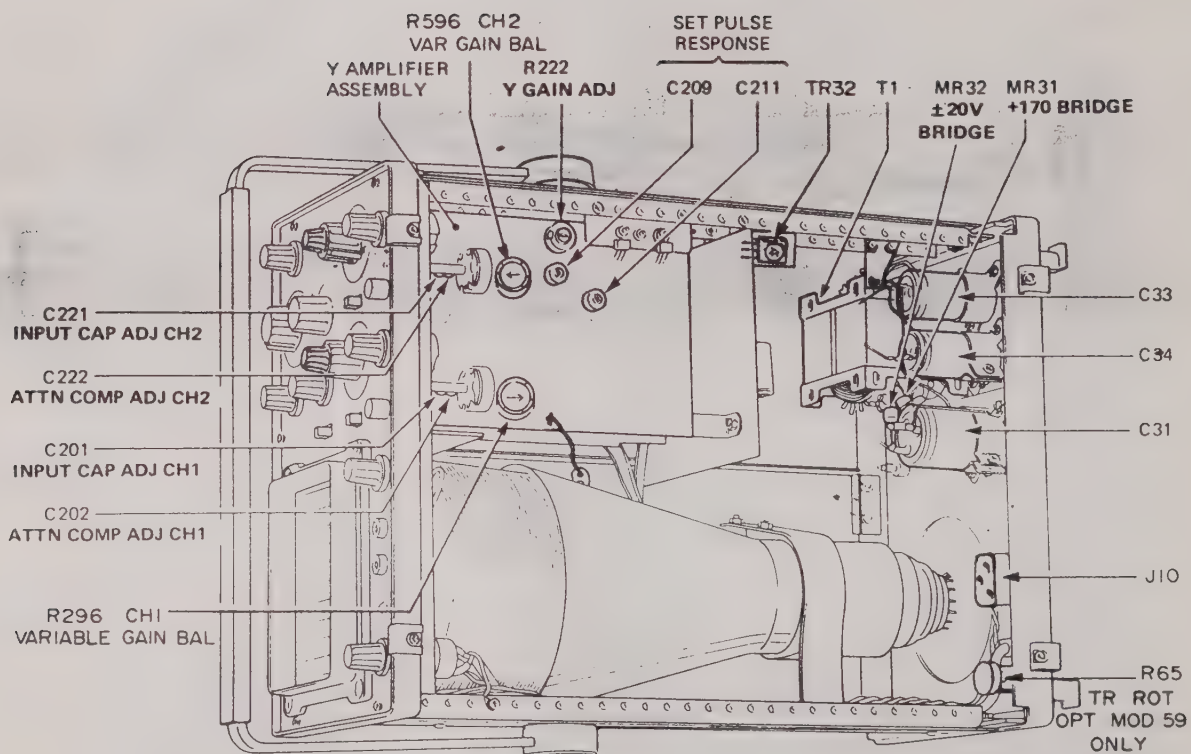


Figure 6-8. 1010A Bottom View

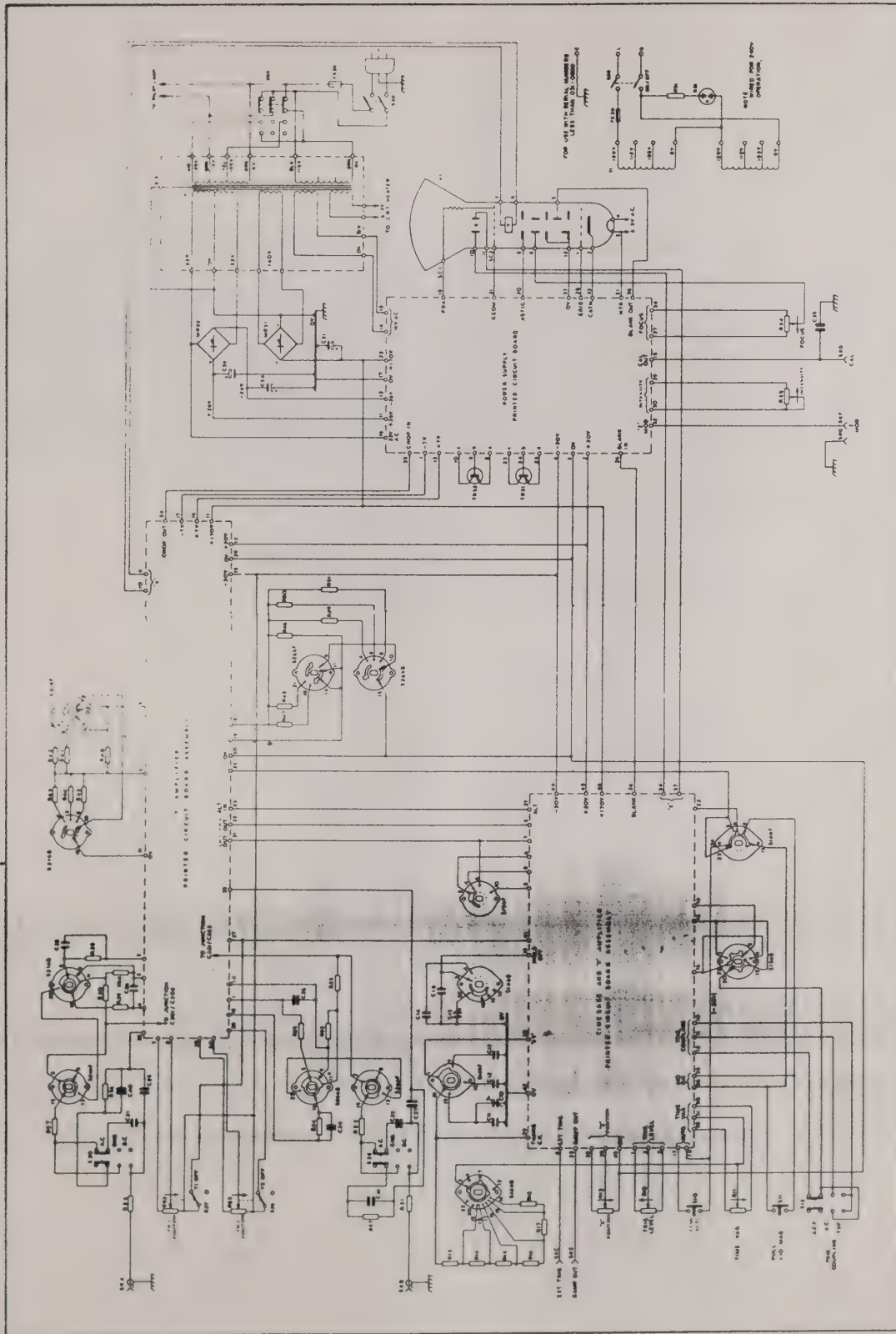


Figure 6-9. Interconnection Diagram
(Serial No. Prefix 031)

INTERCONNECTION DIAGRAM (SERIAL NO. PREFIX 031)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 10	07300010A	CVC 5.5/25PF550. V	72982	TPV 538-014-0.5-5-25
C 11	07022960A	CVM 68 PF 500 V F	84171	ARCO DM-15-680
C 12	07250060A	CVM 0.01UF160.0 VF +1X	84171	ARCO DM30-103F
C 13	07100960A	C8M 1.00F 200.0 VF	14752	ELECTROCUBE 625D1C105F
C 14	07023710A	CNN 67 YF 200 V K 10X	56289	SPRAGUE TYPE 192P
C 15	07100590A	CVF 4.7UF 100.0V N	34553	AMPEREX C280AH/AMN7
C 16	07095790A	CCD 1 NF 150 V K 10X	71590	CTL TYP CE-102
C 21	07250030A	CVM 0.1 UF400.0 VK +-20X	56289	416P10404L3 RADIAL LEADS
C 22	07025950A	CCD 20. NF 500 V M+-20X	72982	ERIE YSW STYLE 841 GP 6
C 23	07250060A	CVM 0.1 UF400.0 VK +-20X	56289	416P10404L3 RADIAL LEADS
C 24	07025950A	CCD 20. NF 500 V M+-20X	72982	ERIE YSW STYLE 841 GP 6
C 25	07101540A	CCD 8.2PF 500.0 V NPO+-1PF	72982	ERIE 831 NPO 8.2PF 1P500V
C 26	07250120A	CSM 470.0 PF500.0 K +-51X	50423	SEE 07-02292-0A
C 27	07101540A	CCD 8.2PF 500.0 V NPO+-1PF	72982	ERIE 831 NPO 8.2PF 1P500V
C 28	07250120A	CSM 470.0 PF500.0 K +-51X	50423	SEE 07-02292-0A
C 31	07101720A	GEA 200.0JF 250.0 V CAN/CLMP	90201	MLRY CG5101T250881/14F410
C 33	07101710A	CEA2200.0UF 40.0 V CAN/CLMP	90201	MLAY CG52220040881/14F410
C 34	07101710A	CEA2200.0UF 40.0 V CAN/CLMP	90201	MLAY CG52220040881/14F410
C 40	07021330A	CSM 5.6NF 600 VM 20X	09023	CORNELL DUBLIER MP6056
FS 30	19100080A	FUS .4 A/5B SIZE 0 X20MM	75915	LITTELFUSE 213.400
NR 31	05100060A	DGP BRIDGE RECT G-18M04M	04713	GENERAL INSTRUMENT
NR 32	05100060A	DGP BRIDGE RECT G-18M04M	04713	GENERAL INSTRUMENT
NR 33	14100010A	LMP 12V 2100MA	80795	ITF SCF 1361-0-RO-12
R 10	09100812A	RVC 100.0K 0.5W/SWG S10 R10	50423	A4/32897 1010A
R 11	09100820A	RVC 10.0K 0.5W/SWG S11 R11	50423	A4/32898 1010A
R 12	09100830A	RVC 1.0K 0.5W	50423	A4/32898 1010A
R 13	12125000A	RFF 100.0 K 500 MW F+-1X	16299	CGW NA 60
R 14	12125000A	RFF 100.0 K 500 MW F+-1X	16299	CGW NA 60
R 15	12125460A	RFF 101.0 K 500 MW F+-1X	16299	CGW NA 60
R 16	12125670A	RFF 499.0 K 500 MW F+-1X	16299	CGW NA 60
R 17	12126000A	RFF 1.00M 500 MW F+-1X	16299	CGW TYP NA 65
R 18	12150040A	RFF 3.01M 1.004F +-1X	35929	CONSTANTA CO LTD N3
R 20	12026420A	RCF 990.0 K 500 MW F+-1X	03888	PFF TYP TP-500
R 21	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 22	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 23	12026420A	RCF 990.0 K 500 MW F+-1X	03888	PFF TYP TP-500
R 24	12125640A	RFF 664.0 K 500 MW F+-1X	16299	CGW NA 60
R 25	12126000A	RFF 1.00M 500 MW F+-1X	16299	CGW TYP NA 65
R 26	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 27	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 28	12125640A	RFF 664.0 K 500 MW F+-1X	16299	CGW NA 60
R 29	12126000A	RFF 1.00M 500 MW F+-1X	16299	CGW TYP NA 65
R 31	12124800A	RFF 68.1 K 500 MW F+-1X	16299	CGW NA 60
R 33	09100840A	RVC 220.0 K 0.5W/SWG S30 R33	50423	A4/32899 1010A
R 34	09100850A	RVC 1.0 M 0.5W	50423	A4/32899 1010A
R 40	12124200A	RFF 16.2 K 500 MW F+-1X	16299	CGW NA 60
R 41	12124160A	RFF 14.7 K 500 MW F+-1X	16299	CGW NA 60
R 42	12123680A	RFF 5.11K 500 MW F+-1X	16299	CGW NA 60
R 43	12123230A	RFF 1.74K 500 MW F+-1X	16299	CGW NA 60
R 44	12122840A	RFF 750.0 500 MW F+-1X	16299	CGW NA 60
R 45	12122520A	RFF 348.0 500 MW F+-1X	16299	CGW NA 60
R 46	12124200A	RFF 16.2 K 500 MW F+-1X	16299	CGW NA 60
R 47	12124160A	RFF 14.7 K 500 MW F+-1X	16299	CGW NA 60
R 48	12123680A	RFF 5.11K 500 MW F+-1X	16299	CGW NA 60
R 49	12123230A	RFF 1.74K 500 MW F+-1X	16299	CGW NA 60
R 50	12122840A	RFF 750.0 500 MW F+-1X	16299	CGW NA 60
R 51	12122520A	RFF 348.0 500 MW F+-1X	16299	CGW NA 60
R 52	09100860A	RVC 22.0 K 0.5W/SWG S27 R52	50423	A4/32895 1010A
R 53	09100860A	RVC 22.0 K 0.5W/SWG S27 R52	50423	A4/32895 1010A
R 54	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 55	12121320A	RFF 21.5 500 MW F+-1X	16299	CGW NA 60
R 56	12098210A	RFC 330.0 K 250 MW J+- 5X	01121	A-B TYP CB
R 57	12098210A	RFC 330.0 K 250 MW J+- 5X	01121	A-B TYP CB
S 21	25100651L	SWC 1010A VOLTS/CM ROTARY	50423	BL1 36235
544BC	31033790A	CGN UG-1094/U BNC DAGE	29581	STATE ELECT. PARTS
540F	48100010A	S3C TEFLOM FOTMU TEST PT.	98291	D11-2049/GOLD PLATE
54FCB	48100020A	S3C 4MM BLK BANANA JACK	83330	HM SMITH 81498-103 (BLK)
TR 31	10100100A	TRQ TRANSISTOR TYPE 2N4107	88684	RCA
TR 32	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
Y 1	21100070A	TBE CRT 4KV BX10CM P311010A	50423	THORN D13610GH

NOTE: CH, C33, & C34 replacements may be 1 inch or 1.58 inch high depending on type. Please contact us for part numbers and must be matched with type requiring replacement.

TIMEBASE AND 'X' AMPLIFIER (SERIAL NO. PREFIX 031)

REF	SYM	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 101	C7C95526A	CCD 10C PF 1 KV H 10X	84171	ARC TYP CCD-101	
C 102	C7C95760A	CCD 10 PF 150 V T 40X	84170	CTL TYP DO-103 CAP	
C 103	C707835CA	CEA 25 UF 150 V T 40X	73445	AMPEREX C-26AB/P25	
C 104	C7C95760A	CCD 10 PF 150 V T 40X	84170	CTL TYP DO-103 CAP	
C 105	C7C95760A	CCD 10 PF 150 V T 40X	84170	CTL TYP DO-103 CAP	
C 106	C7C95584E	CCD 33.0PF 500.0VX +10X	52895	SPG TYP C0308102C330K	
C 107	C7010146E	CCD 47C.0PF 10C.0V G VRY	72782	ERIE 8131-100 651 474M	
C 108	C7C95580A	CCD 23.0PF 50C.0VX +10X	72689	SPG TYP C0308102C330K	
C 109	C7C95580A	CCD 23.0PF 50C.0VX +10X	72689	SPG TYP C0308102C330K	
C 110	C7C95580A	CCD 23.0PF 50C.0VX +10X	72689	SPG TYP C0308102C330K	
C 111	C7200C50A	CCD C-1UF 300 VR +10X	71950	CTL CK-104	
C 112	C7200C50A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 113	C71C1131A	CEA 25 UF 25 V V 40X	72981	DISCKEN C-24AB/P25	
C 114	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 115	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 116	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 117	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 118	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 119	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 120	C72CC040A	CCD 27.0PF 56C.0V VR +10X	71950	CTL DO-270	
C 121	C70W952CA	CCD 100 PF 1 KV K 10X	84171	ARC TYP CCD-101	
C 122	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 123	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 124	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 125	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 126	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 127	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 128	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 129	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 130	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 131	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 132	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 133	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 134	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 135	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 136	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 137	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 138	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 139	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 140	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 141	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 142	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 143	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 144	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 145	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 146	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 147	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 148	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 149	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 150	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 151	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 152	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 153	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 154	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 155	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 156	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 157	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 158	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 159	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 160	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 161	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 162	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 163	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 164	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 165	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 166	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 167	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 168	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 169	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 170	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 171	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 172	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 173	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 174	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 175	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 176	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 177	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 178	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 179	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 180	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 181	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 182	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 183	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 184	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 185	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 186	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 187	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 188	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 189	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 190	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 191	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 192	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 193	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 194	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 195	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 196	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 197	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 198	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 199	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 200	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 201	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 202	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 203	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 204	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 205	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 206	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 207	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 208	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 209	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 210	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 211	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 212	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 213	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 214	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 215	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 216	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 217	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 218	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 219	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 220	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 221	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 222	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 223	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 224	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 225	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 226	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 227	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 228	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 229	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 230	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 231	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 232	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 233	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 234	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 235	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 236	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 237	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 238	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 239	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 240	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 241	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 242	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 243	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 244	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 245	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 246	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 247	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 248	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 249	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 250	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 251	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 252	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 253	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 254	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 255	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 256	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 257	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 258	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 259	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 260	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 261	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 262	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 263	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 264	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 265	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 266	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 267	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 268	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 269	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 270	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950	CTL DO-270	
C 271	C70C6040A	CCD 27.0PF 50C.0V VR +10X	71950		

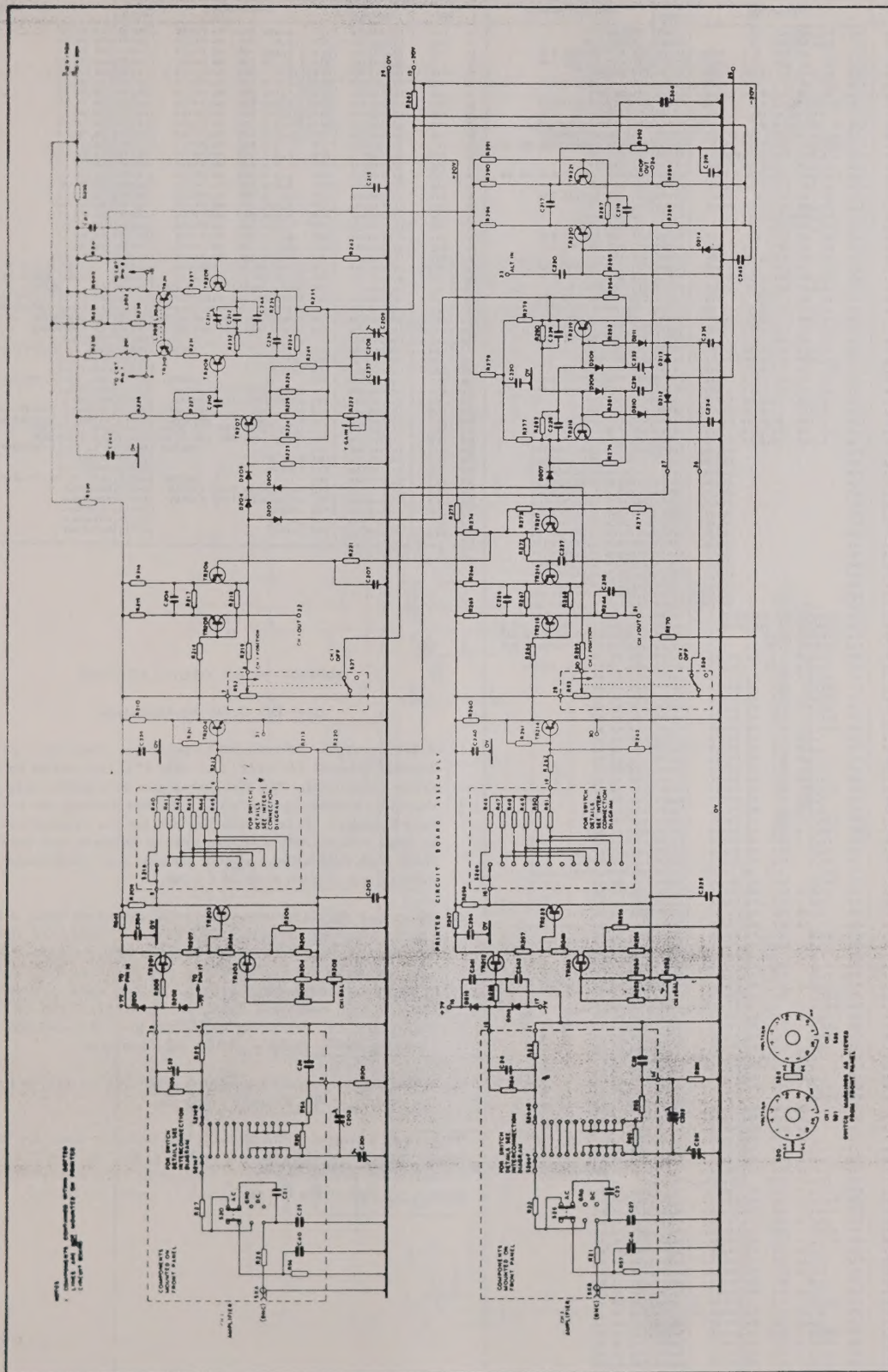


Figure 6-11. 'Y' Amplifier
(Serial No. Prefix 031)

'Y' AMPLIFIER (SERIAL NO. PREFIX 031)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 201	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 202	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 203	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 204	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 205	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 206	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 207	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 208	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 209	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 210	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 211	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 212	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 213	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 214	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 215	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 216	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 217	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 218	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 219	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 220	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 221	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 222	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 223	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 224	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 225	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 226	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 227	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 228	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 229	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 230	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 231	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 232	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 233	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 234	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 235	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 236	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 237	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 238	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 239	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 240	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 241	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 242	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 243	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 244	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 245	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 246	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 247	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 248	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 249	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 250	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 251	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 252	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 253	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 254	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 255	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 256	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 257	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 258	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 259	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 260	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 261	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 262	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 263	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 264	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 265	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 266	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 267	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 268	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 269	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 270	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 271	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 272	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 273	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 274	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 275	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 276	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 277	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 278	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 279	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 280	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 281	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 282	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 283	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 284	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 285	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 286	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 287	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 288	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 289	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 290	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 291	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 292	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 293	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 294	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 295	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 296	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 297	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 298	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 299	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E
C 300	C73000CCA	CWC -8/6-BPF400- V	73445	C0004EA/6E

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 271	12123800A	RFF 6.81K 500 MW F-1E	16299	CGW NA 60
R 272	12121640A	RFF 46.4 500 MW F-1E	16299	CGW NA 60
R 273	12123240A	RFF 1.96K 500 MW F-1E	16299	CGW NA 60
R 274	12123320A	RFF 2.15K 500 MW F-1E	16299	CGW NA 60
R 275	12121000A	RFF 10.0 500 MW F-1E	16299	CGW NA 60
R 276	12124320A	RFF 21.5 500 MW F-1E	16299	CGW NA 60
R 277	12123240A	RFF 1.77K 500 MW F-1E	16299	CGW NA 60
R 278	12123400A	RFF 2.61K 500 MW F-1E	16299	CGW NA 60
R 279	12123240A	RFF 1.78K 500 MW F-1E	16299	CGW NA 60
R 280	12124160A	RFF 14.7 K 500 MW F-1E	16299	CGW NA 60
R 281	12124320A	RFF 21.5 K 500 MW F-1E	16299	CGW NA 60
R 282	12124320A	RFF 21.5 K 500 MW F-1E	16299	CGW NA 60
R 283	12124160A	RFF 14.7 K 500 MW F-1E	16299	CGW NA 60
R 284	12124320A	RFF 21.5 K 500 MW F-1E	16299	CGW NA 60
R 285	12123020A	RFF 1.0 K 500 MW F-1E	16299	CGW NA 60
R 286	12123540A	RFF 3.83K 500 MW F-1E	16299	CGW NA 60
R 287	12124400A	RFF 26.1 K 500 MW F-1E	16299	CGW NA 60
R 288	12123240A	RFF 1.78K 500 MW F-1E	16299	CGW NA 60
R 289	12123640A	RFF 4.64K 500 MW F-1E	16299	CGW NA 60
R 290	12123800A	RFF 6.81K 500 MW F-1E	16299	CGW NA 60
R 291	12124400A	RFF 10.0 K 500 MW F-1E	16299	CGW NA 60
R 292	12124400A	RFF 26.1 K 500 MW F-1E	16299	CGW NA 60
R 293	12124500A	RFF 33.2 K 500 MW F-1E	16299	CGW NA 60
S 20	25100000A	SWC SLIDE DP TT 106A85	50423	25869/ARIEL RA 2405
S 25	25100000A	SWC SLIDE DP TT 106A85	50423	25869/ARIEL RA 2405
S 26	251000651	SWC 1010A VOLTS/CM ROTARY	50423	ALL 36235
S 27	09101031A	RVC SKCTE22K SWC DUAL1010-59	11236	CFS FR-VF-C47-45-30
S 28	09101031A	RVC SKCTE22K SWC DUAL1010-59	11236	CFS FR-VF-C47-45-30
TR 201	10100000A	TRQ TRANSISTOR PET TYP UC73A	21845	SEE 10079330A
TR 202	10100000A	TRQ TRANSISTOR PET TYP UC73A	21845	SEE 10079330A
TR 203	10100000A	TRQ TRANSISTOR PET TYP UC73A	21845	SEE 10079330A
TR 204	10094650A	TRQ 2N3906	04713	REF. TO 10-10043-0A
TR 205	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 206	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 207	10094650A	TRQ 2N3906	04713	REF. TO 10-10043-0A
TR 208	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 209	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 210	10100504A	TRQ MPN 180V	21845	SEE 10079330A
TR 211	10094730A	TRQ 2N3906	04713	MOTOROLA
TR 212	10100000A	TRQ TRANSISTOR PET TYP UC73A	21845	SEE 10079330A
TR 213	10100000A	TRQ TRANSISTOR PET TYP UC73A	21845	SEE 10079330A
TR 214	10094650A	TRQ 2N3906	04713	REF. TO 10-10043-0A
TR 215	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 216	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 217	10094650A	TRQ 2N3906	04713	REF. TO 10-10043-0A
TR 218	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 219	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 220	10094730A	TRQ 2N3906	04713	MOTOROLA
TR 221	10094730A	TRQ 2N3906	04713	MOTOROLA
TR 222	10094730A	TRQ 2N3906	04713	MOTOROLA

MODEL 1010A OSCILLOSCOPE

Low DC Drift Modification

1. A temperature differential between the transistor pairs TR203/204 and TR222/214 of only 1°C can result in 2 mV trace movement. The likelihood can be significantly reduced by extending the leads and heat sinking the transistors together. This is done by putting the transistors head to head with a little silicone grease between and covering them both with a heat-shrink sleeve; i.e. transistor leads coming out of both ends of a tube.
2. Biased as they are at the moment, the same kind of shift can be expected from the FET pairs, TR201/222 and TR212/213. The FET's can be heat sunked together in a similar fashion but in addition, temperature drift can be reduced by increasing the bias. This is done by changing the 470 ohm resistors R207, R205, R257, R255 to 1k ohm metal film and restoring the slight loss of bandwidth by shunting R207, R257 with 100 pF capacitors.
3. R206, R256 should be changed from 39K to 82k to improve the setting of the balance controls.

With these changes and assuming the balance controls have been set for zero shift (0.5 V to 0.2 V/dia. on the attenuator) 1 hour after switch on, trace movement 10 minutes after switch-on should not exceed 2 mV (2 small divisions).

POWER SUPPLY (SERIAL NO. PREFIX 031)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 35	07095760A	CCD 10 MF 150 V T 40X	71590	CTL TYP DD-103 CAP
C 301	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 302	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 303	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 304	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 305	07200120A	CCD 0.01UF 1.5KVX GWK	71590	CTL DD16-103
C 306	07200110A	CCD4700.OPF 4.0KVX-10X	91418	HI-KHI-V DISCAP GWV
C 307	07200110A	CCD4700.OPF 4.0KVX-10X	91418	HI-KHI-V DISCAP GWV
C 308	07200110A	CCD4700.OPF 4.0KVX-10X	91418	HI-KHI-V DISCAP GWV
C 309	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 310	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 311	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 312	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 313	07022390A	CGW 10.0NF1000 V	84171	ARCO SILVER HI-K CCD-103
C 314	07100350A	CCD 470. PF 1 KV DC	84171	ELMENCO TYPE CCD471
C 315	07101480A	CEA 4.0UF 450.0 V	56289	5000405F450EH7
C 316	07100590A	CYP 4.7UF 100.0V M	36553	AMPEREX C280AN/ANM7
C 317	07095760A	CCD 10 MF 150 V T 40X	71590	CTL TYP DD-103 CAP
C 318	07095760A	CCD 10 MF 150 V T 40X	71590	CTL TYP DD-103 CAP
C 319	07095760A	CCD 10 MF 150 V T 40X	71590	CTL TYP DD-103 CAP
D 301	05100460A	DRS 4. KV 0.25 AMP MR995A	04713	MOTOROLA
D 302	05100460A	DRS 4. KV 0.25 AMP MR995A	04713	MOTOROLA
D 303	05100460A	DRS 4. KV 0.25 AMP MR995A	04713	MOTOROLA
D 304	05100020A	DGP 1M4007	12954	DICKSON ELECTRONICS
D 305	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 306	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 307	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 308	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 309	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 310	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 311	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 312	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 313	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 314	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
D 315	05079100A	DZP 6.8V +15X	1N957B	27832 JUGHES
D 316	05079100A	DZP 6.8V +15X	1N957B	27832 JUGHES
D 317	05100020A	DGP 1M4014	12954	DICKSON ELECTRONICS
F 30	19034000A	FUS 1AMP TYPE 3AG	75915	LITTLEFUSE
NR 301	05100060A	DGP BRIDGE RECT G.18M04M	04713	GENERAL INSTRUMENT
N 31	16100080A	LMP INDICATOR, NEON TYPE 0	95243	LEECRAFT 45RN2117
R 301	12123720A	RFF 5.6K 500 MW F-1X	16299	CGW NA 60
R 302	12123000A	RFF 1.0 K 500 MW F-1X	16299	CGW NA 60
R 303	12123480A	RFF 8.25K 500 MW F-1X	16299	CGW NA 60
R 304	09100080A	RVC 10.0 K 0.5 WK +10X	73138	HEL TYP 72PM
R 305	12125000A	RFF 100.0 K 500 MW F-1X	16299	CGW NA 60
R 306	12124640A	RFF 46.4 K 500 MW F-1X	16299	CGW NA 60
R 307	07100290A	CCD 68PF 1KV	84171	ELMENCO TYPE CCD680
R 308	12121880A	RFF 82.5 500 MW F-1X	16299	CGW NA 60
R 309	12123000A	RFF 1.0 K 500 MW F-1X	16299	CGW NA 60
R 310	12123320A	RFF 2.15K 500 MW F-1X	16299	CGW NA 60
R 311	12123120A	RFF 1.33K 500 MW F-1X	16299	CGW NA 60
R 312	12124160A	RFF 14.7 K 500 MW F-1X	16299	CGW NA 60
R 313	12011090A	RFC 5.6 500 MW J-5X	01121	A-B TYP EB
R 314	12121880A	RFF 82.5 500 MW F-1X	16299	CGW NA 60
R 315	12123320A	RFF 2.15K 500 MW F-1X	16299	CGW NA 60
R 316	12123120A	RFF 1.33K 500 MW F-1X	16299	CGW NA 60
R 317	12124160A	RFF 14.7 K 500 MW F-1X	16299	CGW NA 60
R 318	12124640A	RFF 46.4 K 500 MW F-1X	16299	CGW NA 60
R 319	12124600A	RFF 42.2 K 500 MW F-1X	16299	CGW NA 60
R 320	09100080A	RVC 10.0 K 0.5 WK +10X	73138	HEL TYP 72PM
R 321	12125160A	RFF 1.47M 500 MW F-1X	16299	CGW TYP NA 65
R 322	12200000A	RFF 3.3 M 2.0 W 58H18B	03327	WELBYN TYPE DC-2
R 323	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
R 324	12124640A	RFF 46.4 K 500 MW F-1X	16299	CGW NA 60
R 325	12125000A	RFF 100.0 K 500 MW F-1X	16299	CGW NA 60
R 326	12124640A	RFF 46.4 K 500 MW F-1X	16299	CGW NA 60
R 327	12124640A	RFF 46.4 K 500 MW F-1X	16299	CGW NA 60
R 328	12010800A	RFC 4.7 M 500 MW K-10X	01121	A-B TYP EB
R 329	12125400A	RFF 261.0 K 500 MW F-1X	16299	CGW NA 60
R 330	12125160A	RFF 1.47M 500 MW F-1X	16299	CGW TYP NA 65
R 331	09100090A	RVC 250.0 K 0.5 WK +10X	73138	HEL TYP 72PM
R 332	09100080A	RVC 500.0 K 0.5WK 30X GERMET	73138	HELIPOT 72PM TRIMPOT MINI
R 333	12125000A	RFF 100.0 K 500 MW F-1X	16299	CGW NA 60
R 334	12127640A	RFF 27.0 K 2.0 W 5X	16299	CORNING TYPE C425
R 335	12124170A	RFF 15.0 K 500 MW F-1X	16299	CGW NA 60
R 336	12124330A	RFF 22.1 K 500 MW F-1X	16299	CGW NA 60
R 337	12123640A	RFF 4.64K 500 MW F-1X	16299	CGW NA 60
R 338	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
R 339	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
R 340	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
R 341	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
R 342	12127630A	RFC 2.2 M 600.0MW 5X	01121	A-B TYPE EB OR EQUIV.
S 30	09100080A	RVC 220.0 K 0.5W/SWC 530 R33	50423	RLI - FOR PRIMARY SWC
T 1	20100241L	TRX 1010A POWER	04713	MOTOROLA
TA 301	10100122A	TRQ TRANSISTOR TYPE MJE3439	04713	MOTOROLA
TA 302	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TA 303	10300020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TA 304	10094730A	TRQ 2N3906	04713	MOTOROLA
TA 305	10094730A	TRQ 2N3906	04713	MOTOROLA
TA 306	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TA 307	10100010A	TRQ TRANSISTOR TYPE 2N2349	04713	MOTOROLA
TA 308	10100112A	TRQ TRANSISTOR TYPE 2N5831	07243	FAIRCHILD
S 90	25100910A	SWC 3P3T SLIDE SWC	50423	BALLANTINE
UNITS WITH SERIAL NUMBERS BELOW 031-0400				
F 1	20100181A	TRX 1010A PWR	50423	RLI